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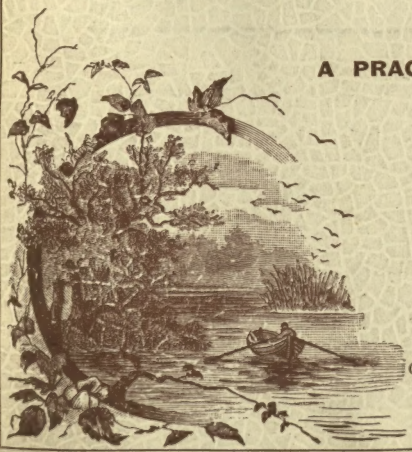
PHOTOGRAPHIC ENLARGEMENTS:

HOW TO MAKE THEM.

By GEO. WHEELER.

A PRACTICAL HANDBOOK.



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A LIST OF WHEELER'S PHOTOGRAPHIC HELPS WILL BE FOUND AT THE END.

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BY

GEO. WHEELER,

EDITOR OF

"THE PHOTOGRAPHIC RECORD," "WHEELER'S EXPOSURE REGISTER AND TABLES," "WHEELER'S BROMIDE PRINTING REGISTER," &c., &c.

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PREFACE.

EVIDENCES of a demand for information on the subject treated of in this handbook, is the sole cause of its production. It is free from any attempt to push some special make of paper or apparatus to the front, and to that extent is unbiased. The hints and recommendations given are in almost every case the result of actual experience.

I have endeavoured to treat the subject from a practical standpoint rather than deal with theoretical and scientific surroundings, and believe the course taken will commend itself to photographers generally.

If I have failed to express myself distinctly, or the information is lacking upon any point, I shall only be too glad to acknowledge and remedy it in a future edition.

My great hope is that it may prove helpful to others.

GEO. WHEELER.

SECTION I.

ON THE MAKING OF ENLARGEMENTS.

It affords Pleasure.

THE photographer who has not hitherto attempted to make enlargements from his best negatives has a pleasure yet in store. Of all the multifarious sections offered by photography there is none that affords more interest of an engrossing and pleasurable kind than the branch with which these pages attempt to deal. Its fascinating influence can only be appreciated by those who have undertaken it. There is an absence of "dull care" in all the attendant operations; the interest is sustained, and becomes intensified after a few successes, and is something akin to the feeling that takes possession of the artist as he sees the "thing of beauty" he is aiming at, growing before him. Difficulties there may be, which must be surmounted, but they are only such as attend every effort to obtain that which is of value, and are well indicated by Hazlitt, where he speaks of the hindrances of the painter: "He is taken up, not with the difficulties, but the triumph over them."

In developing ordinary negatives there is always the drawback that after the trouble spent in securing the picture, it may not meet our expectations, and frequently disappointment arises from one cause or another. With an enlargement we know beforehand that the subject is one that gives pleasure or we should not seek to reproduce it in an enlarged form. It was admired in the original size, and we want the legitimate gratification of seeing and realizing its beauty under more imposing and better conditions.

Produces Artistic Effects.

That enlarging a good composition, whether it be landscape or figure subject, improves its general effect and adds artistic value to it is a *sine qua non.* The objections in art circles to the adornment of rooms by photographs are frequently based on the following ideas: that, as a rule, there is too much detail crammed into a small surface, giving a laboured effect; that there is a heaviness about photographs generally, which is not pleasing to the eye; and further that the glaze on ordinary direct prints sins against art teaching. However much these opinions may affect the small everyday photograph when framed and hung—a point with which we have nothing to do at present—most certainly they have no relation whatever to enlargements on bromide, for in each case these supposed errors are corrected. The details are no longer crammed together; the comparative heaviness is dispelled, supposing the enlargement is rightly made; and the glaze is altogether absent. Those who have observed the vast difference in appearance between a well made lantern slide when seen in the hand, and the same picture thrown on the screen, will be ready to admit that there is an amount of reason in these objections. The feebleness—causing the slide to be superficially glanced at and passed quickly to one side—has undergone a transformation by its enlargement; its beauties have been revealed and there is now an interest in dwelling upon its various features, which does not fail with repeated inspection. The improved appearance is largely the result of opening out the beauty that was there previously, but had been dwarfed into insignificance by being presented on too small a scale. In the same way an enlargement on bromide is much more pleasing than a print from the original negative. Its softer outline and milder contrasts, especially when seen at a little distance, lend a charm and mellowness that are rarely obtained from a direct print.

Compares with Platinum.

To compare the appearance of even a successful bromide print with one produced by the platinum process may be considered as a stretch of imagination by some, but there is

good ground for the comparison. Let the same care be observed that the platinum printer exercises in his operations, following the instructions given with the same scrupulous exactitude, and the bromide worker will never need be ashamed of his productions when placed side by side with platinum. Mr. Andrew Pringle supports this position. Writing on enlargements, and the importance of using definite strengths of solution, he asserts, "The resulting prints cannot be told from platinum prints." He then goes on to say, "This is not by any means impossible; the writer has made bromide prints in this way that neither he nor anybody else can tell from platinum prints when the bromides are mounted and framed." There is not the least exaggeration of fact in this assertion. The same softly graded half-tones and strength of image with which the platinum process is associated, may also be obtained in bromide when a negative suited to the requirements of the process is used, accompanied by careful manipulation.

Saves Labour and Expense.

Among the other advantages obtained by adopting a system of making enlargements, is that of not being obliged to carry a heavy camera and a great weight of glass plates. Even the most portable camera over half-plate size, with an accompaniment of three or four double dark slides loaded with plates, is quite sufficient to detract considerably from the pleasure of a long day's tramp, not to mention the fatigue that has to be endured during a tour of a week or a fortnight when the weight of exposed plates has been accumulating day by day. But the question extends further than that of simply reducing the heavy burden of luggage; it embraces the question of less expensive lenses, less costly apparatus, and runs throughout the operations that follow with their attendant paraphernalia. With a quarter-plate camera and half-a-dozen double dark slides, an entire day's journey may be taken without feeling encumbered, more pictures may be secured, and that weariness of the mind which frequently sympathizes with the tired body is avoided.

Besides the expense involved in the purchase of apparatus of large dimensions, already referred to, the cost entailed in buying large plates is in itself a considerable item. If a photographer is at all an active worker, the amount saved in the course of a year by using quarter-plates, and making enlargements from them, compared with the expenditure required for 10 × 8, or even whole plates, will go a long way towards providing an enlarging outfit. Then less storage room for negatives is demanded, not to mention that there is less risk in handling the small sizes.

Should it be desirable at any time to possess a larger negative of a subject, the same instrument that is used for making an enlarged print can also be used to provide the enlarged negative.

Tends to Secure Good Work.

The photographer who has undertaken half a day's journey under the load of a whole-plate, or 10in. × 8in. camera and slides to match, through some hilly district, and perhaps under a broiling sun, is in no fit condition to study the artistic features of a landscape, or to take much trouble about the best position for erecting his camera. He is jaded, and the result is, he wastes large plates on imperfect subjects. Instead of placing his whole soul into his work, his energies are directed to hurrying through, that he may be released from his burden. All this is done away with by adopting the system of using a small camera and making enlargements of such pictures as prove themselves worthy of it.

Independent of Weather.

Another advantage the enlarger has (supposing he has arrangements for using artificial light), he is independent of weather. Even in the winter months, when fog and short days almost preclude all attempts at outside operations, he has a resource, one that will provide a fund of enjoyment. Safely ensconced at home, defying sleet and mist, he may pursue the art of making enlarged pictures to his heart's content, and renew his acquaintance with the scenes and associations that were bright with the past summer.

Many other things might be said in favour of this branch of photography, and if little has been said to indicate that there is another side to the question, it is because there is little to be said on the other side. Given a careful worker, with the necessary conveniences, successful results are sure to follow.

Presents no Great Difficulty.

The successful making of an enlargement depends mainly upon four factors, viz.:

1st. A suitable negative.
2nd. Securing a sharp image.
3rd. Giving a correct exposure.
4th. Using a good developer.

If these factors are secured there need be no fear of success. All the other manipulations are of a minor character, and that they will be performed correctly may be assumed, if the worker has had any experience with photographic operations. Of course I take it for granted that no one would expect a good enlargement from a bad negative, and I am supposing that accuracy and cleanliness are everyday ingredients in all that concerns photography. With these premises I may safely assert that the difficulties of enlarging are comparatively small, and so trifling that there need be no hesitation in making the attempt.

SECTION II.

TABLE OF DISTANCES

BETWEEN NEGATIVE, LENS, AND PAPER.

Focal length of lens in inches		Number of times enlarging—lineal measurements.							
		1	2	3	4	5	6	7	8
4	P	8	12	16	20	24	28	32	36
	N	8	6	5 1/4	5	4 4/5	4 2/3	4 4/7	4 1/2
4 1/2	P	9	13	18	22 1/2	27	31 1/2	36	40 1/2
	N	9	6 3/4	6	5 5/8	5 2/5	5 1/4	5 1/7	5 1/16
5	P	10	15	20	25	30	35	40	45
	N	10	7 1/2	6 2/3	6 1/4	6	5 5/6	5 5/7	5 5/8
5 1/2	P	11	16 1/2	22	27 1/2	33	38 1/2	44	49 1/2
	N	11	8 1/4	7 1/3	6 7/8	6 3/5	6 7/12	6 2/7	6 3/16
6	P	12	18	24	30	36	42	48	54
	N	12	9	8	7 1/2	7 1/5	7	6 6/7	6 3/4
7	P	14	21	28	35	42	49	56	63
	N	14	10 1/2	9 1/3	8 3/4	8 2/5	8 1/6	8	7 7/8
8	P	16	24	32	40	48	56	64	72
	N	16	12	10 2/3	10	9 3/5	9 1/3	9 1/7	9
9	P	18	27	36	45	54	63	72	81
	N	18	13 1/2	12	11 1/4	10 4/5	10 1/2	10 2/7	10 1/8
10	P	20	30	40	50	60	70	80	90
	N	20	15	13 1/3	12 1/2	12	11 2/3	11 3/7	11 1/4
11	P	22	33	44	55	66	77	88	99
	N	22	16 1/2	14 2/3	13 3/4	13 1/5	12 5/6	12 4/7	12 3/8
12	P	24	36	48	60	72	84	96	108
	N	24	18	16	15	14 2/5	14	13 3/7	13 1/2

THE foregoing table indicates the relative positions of the negative, lens, and bromide paper, when enlargements are required so many times larger than the negative.

The first column gives the focal length of lenses, and the top line of figures the diameters of enlargement.

The initials **N** and **P** in the second column represent negative and paper. The figures opposite **N** show the distances between the negative and the optical centre of the lens, and those opposite **P** the distances from the paper on the easel to the lens.

Supposing that a 9-inch lens is in use, and an enlargement three times the length of the negative is wanted. With a half-plate, allowing quarter of an inch margin at each side of the negative, this would mean a picture 18 inches in diameter. To obtain it, the figures show that the distance between the negative and lens should be 12 inches, and the space required between the lens and paper is 36 inches. With a 6 inch lens, 8 and 24 inches indicate the positions sought.

It is not necessary to measure the distance as above whenever an enlargement is made, for the sizes of paper rarely coincide with the dimensions given, but the table supplies a useful data of ratios for reference, especially when erecting apparatus.

SECTION III.

THE PAPER.

TO enter into an elaborate description of the emulsion with which the paper is coated would serve no practical purpose here. Our business is to describe the process of making enlargements. How the paper is made and what its history has been may be left for others to deal with. No advantage would be gained by preparing the paper for individual use, for there is a wide range of excellent qualities on the market, and at such reasonable prices that to attempt to make bromide paper would prove a profitless task. It will be sufficient to state that the paper is coated with a gelatine emulsion embodying the bromide of silver as its sensitive agent, and that the coating is done by machinery.

The essential differences in the several makes or brands offered for sale, embrace little more than various degrees of sensitiveness and different textures of surface. They are usually described as slow, or rapid ; and rough, or smooth.

The slow is intended for use with an intensely actinic light, as daylight or limelight ; and the rapid is best adapted to oil and gaslight, although it may also be employed effectually with limelight.

The qualities termed rapid by different makers are not to be understood as being of equal value in speed, they only indicate the relative ratios of their own brand. That which one maker terms rapid, may in actual practice only be of a medium speed compared with the rapid of another maker. Each requires to be tested. At the same time it should be remembered that speed is not a guarantee of suitability or quality.

The sensitive side is always turned inwards, whether in rolls or sheets. It may be discerned by the tendency of the emulsion to contract on exposure to a dry atmosphere, by curling the paper up at the edges. If there is any doubt on the matter, the question is easily solved by moistening the finger end and applying it to the corner of the sheet; the gelatine surface will become sticky and adhere to the finger.

Keeping Stock.—As with all emulsion surfaces, the stock of bromide paper must be kept in a dry place or it will deteriorate.

Rough *v.* **Smooth.**—The question of rough surfaced papers as against the smooth is not simply one of dimensions, such as "rough for large and smooth for small sizes" as is laid down sometimes. The size ought to occupy little more than a minor position in the matter, while the character of the subject and its interpretation should dominate and influence the decision as to the paper that shall be used. It is essentially an art question, and should be treated from an esthetic standpoint. In addition to carrying the image, the surface of the paper may either contribute towards the delineation of the subject in accordance with its characteristics and the impressions associated with it, or it may injure and undermine its special features. Let us suppose the interior of some entrance hall, embracing staircase, balustrade, pictures, and possibly marble columns or a statuette, all of which present firm and decisive lines, is being dealt with. What would be the effect on a very rough paper? Every line would be made weak, and flatness prevade in place of brilliance and relief; the marble columns would present a mosaic appearance, and a veil of monotony be thrown over the whole scene. We should get an atmospheric effect where it was not wanted. Smooth surfaced paper would evidently suit such a subject much better. But rough surfaces have their place, and add a charm to some enlargements by producing a blending effect that is almost indescribable, and greatly enhances their beauty. Thus, a rugged wild moorland, with distant trees or hills, and plenty of sky, or a crumbling old ruin—

neither of these presenting hard or straight lines, although they may possess an abundance of pictorial beauty—are benefited by being presented on a rough surface, because it harmonizes with their respective features. In like manner rustic cottages, woodland scenery, and open landscapes exhibiting distant objects that call for an atmospheric rendering lend themselves to rough paper. In opposition to this, modern buildings, interiors of churches, monuments, and large portraits are better represented on smooth paper. These suggestions are not laid down as hard and fast lines. There is a latitude in both directions, which can only be supplied by the exercise of artistic taste applied to the special subject in hand.

The tendency, as indicated by photographic exhibitions lately held, to use rough papers indiscriminately, for all or any subjects if the size be large, is a mistake, and should not be followed. In a review of the pictures displayed at the last exhibition of the Photographic Society of Great Britain, Mr. H. P. Robinson, a well qualified judge, makes the following observation on rough surfaces: "A feature this year is the number of prints on extra rough paper. This paper may be called the charity which covers many photographic sins. It puts atmosphere into photographs which were devoid of landscape beauty, helps to hide defects, and in some cases is undeniably effective; but in the hands of many who can find art only in material or process, it is a stumbling-block in the way to that better art which comes from knowledge."

Rates of Speed.—It would be unfair to the manufacturers of bromide paper to attempt to give the rates of one make as against the others. The figures would be misleading, and do more harm than good. Two workers would rarely obtain the same results, because the conditions under which they worked would vary, and their methods of development might be totally different. Besides, figures are not always indicative of quality or suitability. A test slip carefully exposed and developed, offers practical experience that can always be relied on.

The various speeds supplied by makers who produce more than one variety are given in the formulæ pages.

SECTION IV.

THE NEGATIVE.

BEGINNING with a suitable negative is half way towards securing a good enlargement. Just as platinotype and other processes demand a peculiar character of negative if the best results they are capable of are to be obtained, so bromide enlargements call for a special class of negative suited to the method. Unless this is secured there cannot be perfection. Certainly there is an amount of latitude in density that can be controlled by the exposure and development, but it is somewhat limited, and it is better to develop the negatives so as to gain the requisite qualities, or to use only such negatives as possess them.

The Kind of Negative Required.—Technically good negatives should possess the following qualities :—

A sharp image all over,
Plenty of detail in the shadows,
A uniform colour,
Free from scratches and other imperfections,
Not dense in any part.

The first and the last of these requirements are the most important; the others, if weak, may be managed more or less successfully by special treatment. The necessity for a sharp image is patent, because no amount of sharpening in the enlarging camera will overcome an initial failing in the original. If the negative is bad in this respect, the enlargement is sure to be worse.

The question of density is only second to that of sharpness. Unless the light can penetrate the film of the negative, and affect the sensitive surface of the paper, there will be no image. A prolonged exposure, using a strong illuminant, might penetrate what is termed a dense negative and supply a tone to the high lights, but it would be at the expense of the shadows; the detail in them would be destroyed. A very thin negative would be better to deal with, because the exposure could be made short, in conjunction with a weak light, and the development forced by extra alkali so as to bring up the image. A brilliant negative that gives a vigorous and pleasing silver print, usually produces a harsh enlargement. Less vigour is wanted. The highest lights should be slightly transparent, and all extremes avoided.

The Development of Negatives intended for enlargement should be undertaken with the idea of securing all the detail, with less density than usual.

If the subject is wanting in contrast, or the exposure has been rather full, the ordinary strength of developer applied tentatively may accomplish the end sought. But if the exposure has been that usually given, and especially if the scene contains strong contrasts, the development must be modified, or the enlargement will be of a soot-and-chalky character. Therefore, reduce the proportions of the developing agent and the restrainer, and use the full quantity of the accelerator. This should bring out the detail, and repress all tendency to block up the high lights. Apply the solution gradually, and examine the progress by holding the plate occasionally against the ruby light. When sufficient density is obtained, stop the development at once.

When the pyro-ammonia developer is used, omit sulphite of soda altogether from the solution, as its tendency is to give clear glass and dense high lights at the expense of the half-tones. A brown evenly-distributed tone in the negative is almost a guarantee that it will produce an evenly-graded enlargement. The clear "black and white" negative may look pretty, but is deceptive. "A tree is known by its fruit."

How to Deal with Imperfect Negatives.—One of the advantages of enlarging on bromide is that better results can be obtained from weak and damaged negatives than by any other process in photography. The only exception to this is when the image on the film is so dense that the light cannot penetrate through and perform its work. Perfect enlargements cannot be expected from an imperfect original, but many of the failings to which negatives are liable may be overcome in one form or another, and, at least, a passable print secured. It is not advisable that these faulty negatives should be used if better can be obtained. Unfortunately the operator cannot always control the matter. Subjects have to be dealt with that are valuable for other reasons than their pictorial qualities, and sometimes the negative, such as it is, good, bad, or indifferent, must be used and the best made of it. Scenes that are no longer in existence, portraits of deceased persons, transitory natural effects, and similar subjects come within this category. With all their failings, an enlargement from them would be prized. They are nearly all susceptible of improvement, and it is surprising what awkward defects can be overcome by the application of judicious treatment.

The question should be, what is the best method of modifying the blemishes? We do not purpose to give remedial measures in detail at this point, as they are dealt with in a separate chapter later on, but we wish to suggest the different courses of treatment that are available. These may be used separately or in combination.

The negative may be retouched before exposure. Supposing a number of scratches or abrasions of the film have to be dealt with. As there is nothing but clear glass

where these occur, the marks must be neatly painted over with a colour that shall match the image that has been displaced, or a non-actinic colour used that will leave a blank mark on the enlargement. The latter course will be found to be the easiest, as the operation of repairing a scratched negative that is to be enlarged from, is one that only an experienced retoucher can manage successfully. The white mark on the enlargement can be readily touched up by a crayon afterwards, so that the defect will scarcely be discernible. A water colour applied with a fine sable or camel-hair brush may be used for painting the negative. If, on holding up the plate to the light the injury is not sufficiently blocked out, a second coat of thicker colour should be applied either to the back or front. Payne's grey, sepia and indigo will be found suitable colours for matching the colour of the film. If the sky or background is badly injured, it may be entirely painted out, and a new one introduced by a second exposure from another negative. By such treatment as now suggested most of the defects in the film may be obviated.

When the failing is one of irregular development or fog, it may be overcome in the exposure and development. We will suppose a case. One corner of the negative is almost clear glass, while the other parts are fully dense. An ordinary exposure would cause the clear part to develop and obliterate all the details, representing them as a black patch, long before the dense part had begun to reveal itself. It must be dealt with by giving a short exposure suitable to the thin portion, and then shielding that part while the denser portions receive a much longer exposure. In the same way stains that are not very pronounced may be dealt with. These irregularities may to some extent be managed in the development by allowing the solution to remain over the backward portions for a longer time, and stopping the progress of the parts that are complete. For this purpose the eikonogen developer is strongly recommended, as the action of any part may be arrested by the application of water. Trial slips, accurately timed both in exposure and development, should be made on the weak places in the negative.

The enlargement may be retouched after the final washing and drying. A finely-pointed crayon for sharp lines, and a stump for shades will perform wonders. The emulsion on the surface is difficult to work on, but it can be done. If the photographer is not capable to undertake this, a retoucher may be got to finish it, or a friend who is handy with the pencil may be pressed into the service.

Position in the Camera.—Place the negative upside down in the carrier or dark slide, and turn the glass towards the light. This will throw the image into its proper position upon the bromide paper.

SECTION V.

DAYLIGHT *versus* ARTIFICIAL LIGHT.

TO decide which of the two methods, viz., enlarging by daylight as against artificial light, is the best to adopt is a matter that cannot be attempted unless the surroundings of the individual are known. The method that would be right for one would be wrong for another. Its solution largely depends on the environments of the operator.

The Best Results.—We are almost in a similar position if the question is asked as to which of the two methods produces the best pictures. Each has its advocates, and by each successful results have been achieved. The fact is, either method may be made to afford the best quality of work, if the requirements of the situation are properly understood. The reason why one individual can produce better results with daylight than artificial light, is because in nearly every case his negatives are strong, and more suited to the strongly actinic daylight. If he adapted his negatives to the milder light, he might express himself in terms quite the reverse. So that each of the methods is equally capable of excellent work when operated with under the conditions that are suited to it.

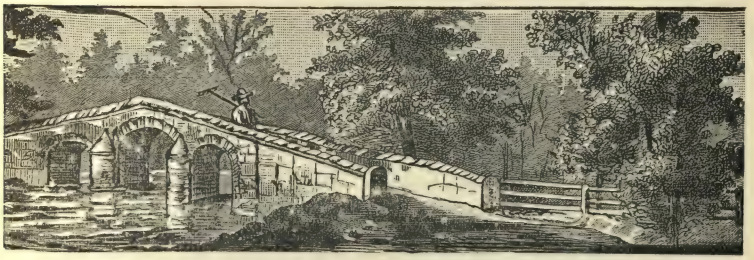
Pros. and Cons.—The decision as to whether daylight or artificial light shall be adopted ought to be influenced by a consideration of the benefits and objectionable features presented by the two systems. The advantages gained on the one side are discounted by attendant disadvantages; and the failings on the other side receive compensation

by the additional facilities it offers; so that before deciding to adopt either of the methods, it is advisable to take more than a superficial glance at their bearings.

A brief notice of some of these gains and losses may be worthy of consideration, for the sake of those who hitherto may not have attempted to make enlargements. The arrangements for utilizing daylight are less costly than those involved in the use of artificial light. There is no necessity to purchase a special enlarging lantern, or in its place condensers and other accessories; the provision of oil, gas, lime-light, or other form of illumination is not called for, nature providing the light gratis; in addition to these advantages there is a decided gain in time, because daylight requires vastly less time to do its work compared with a powerful oil lamp, and a strong light is best suited to some negatives. The points enumerated represent so much to the credit side of daylight. Now what about the debit? In the first place, and it is an important feature in the case, the daylight is not constant—it is ever changing. By the time a trial slip has been made and developed, the ever-varying movements of the clouds has increased or decreased the actinic value of the light. The exposure may be right, but it may be wrong. Then there is the objection that in the evenings—and they are long in winter—nothing can be done; the work, however interesting or profitable, is completely stopped. Some of the disadvantages attending the use of artificial light may be gathered from what has already been said. An instrument has to be purchased, and if the pocket will allow it, let me recommend that a good one that can be relied on be obtained. If this is for large negatives it will run into a considerable sum of money. Then some method of illumination will have to be adopted. Oil is mostly used. An objection is sometimes made to the smell emitted by paraffin oil, but it rests on a poor foundation, because the fault is often in the careless use of the oil, or in consequence of a cheap quality being used. There are plenty of clarified oils, ready camphorated, to be got from the photo. material dealers, that are almost without smell; so that this failing need not exist. If the lime-light is decided upon, a stock of gas will have to be kept either in

bottles or bags, and the necessary care taken to secure safety from them. These are the principal objections against artificial lighting. They may be weighty, but they are more than counterbalanced by two important advantages that it offers, viz: a light that possesses a fixed value, or that can be regulated at will, and one that may be utilized at any time of the day or night, and in any weather.

Having enumerated the "pros. and cons.," the whole questionresolves itself into that of deciding which of the two is best suited to the circumstances and requirements of the individual. If we have plenty of spare time in the middle of the day, and cost must be taken into account, then daylight may serve the purpose; but if business or other engagements only permit of the evenings to be at liberty, or there is no room in the house that is suited to the utilization of daylight, there is no way out of the difficulty but by having recourse to artificial light. The expense which elaborate apparatus involves may be minimized considerably if a little ingenuity can be exercised. Later in this book several suggestions are given for apparatus which may be partly or entirely constructed at home, either with or without the assistance of a joiner, and that will give excellent results. Nevertheless, if it can be managed, the purchase of a good sound instrument, specially constructed for the purpose, will give the most satisfaction.



SECTION VI.

ENLARGING BY DAYLIGHT.

ARRANGEMENTS for making enlargements by daylight are comparatively simple. There is nothing complicated, nor any call for special technical abilities, so that anyone with a little ingenuity and in possession of a few joiner's tools can make the necessary fittings. In addition, the cost is trifling; it embraces little more than the purchase of a few pieces of timber. Supposing the use of a small room with a direct light in it can be secured in the upper portion of the house, there is no difficulty of any moment to be overcome. Even an attic with a roof-light may be utilized; indeed, a dormer light is often preferable to an ordinary window where there is over-shadowing trees or buildings. It is not of much importance if there are no conveniencies for developing in the room, because after exposure, the sheet of bromide paper can be placed between the leaves of a larger book, or rolled up securely in brown paper, or placed in a light-tight cardboard box, and be carried into the ordinary dark room to be developed. Nevertheless it contributes to comfort, if the development can be carried on in the same or an adjacent room to that in which the exposure is made.

Light.—This is the first thing to be considered. It should be understood that the great failing attendant upon enlarging by daylight is in connection with the lighting.

But for this weakness the advocates of artificial light would be considerably reduced in number, for daylight possesses the advantages of being more powerful, costs nothing, and avoids the necessity of providing a lot of costly additional apparatus. Paying special attention to the light is therefore of primary importance.

A north or north-east light is best. It is photographically purer than that coming from any other point of the heavens, and is more free from irregularities. Being sheltered from the direct rays of the sun, there is less risk of a change in the actinic value of the light occuring between the exposure of a trial slip and the large sheet. The light coming from either south or west is subject to greater variableness. The passing clouds, at one moment obscuring the sun, and directly afterwards revealing bright sunshine, introduce an uncertain factor capable of working confusion, and in consequence the preference should be given to a window having a north or a north-east aspect. If circumstances will not permit of this arrangement, any of the others can be utilized, only certain safeguards must be adopted to minimize the attendant disadvantages.

If a northern aspect cannot be secured, then an eastern light is preferable to one coming from either south or west. The grey light of the morning contains a larger proportion of the blue and indigo rays, while, as we hardly need to point out, the yellow and orange rays begin to predominate as the sun approaches its setting in the west. Not only are these blue rays valuable for photographic purposes, being strong in chemical power, but they are of a softer and more uniform character than those from the south or west.

When mist prevails the chemical rays of the sun are greatly retarded, and a much longer exposure will be required. The latter remark also applies to heavy leaden skies.

During a dry east wind the actinic power of the light is increased, because there is less vapour in the atmosphere. A rainy south-west wind brings with it an amount of aqueous vapour, and thereby reduces the chemical value of the light.

As a rule, the light is more intense and contains a larger proportion of ultra-violet rays just before mid-day than any other time. As the day advances, extra vapour is created by the continued heat of the sun, and in addition, the thickness of the atmosphere to be penetrated by the source of light becomes greater as each hour goes by.

Masses of white clouds on an azure sky act as reflectors of light, increasing its intensity.

An extra screen should be made for use with a south or west light, so that it can be inserted when the sun is playing pranks by alternately throwing its rays on the window and then withdrawing them again. A very simple affair, such as a piece of tracing-paper stretched over a wood frame, and detachable at will, serves the purpose. When the sky is overcast there is no necessity for its use.

Prefer a day offering a steady diffused light, as when the sun is obscured by long stretches of thin clouds, to one that is sunny and then overcast by turns. A uniformly dull leaden sky is better than the latter. The difference of a few seconds or even minutes in the exposure is of small importance compared with the great advantage that a constant light secures. No danger need be apprehended that the light will be wanting in efficiency, unless the day happens to be one of unusual dullness; it is only a question of a little more time, and for a weak negative the dull sky will prove the most suitable.

Screen for Window.—All daylight, except that which is to come through the aperture left open to receive the end of the camera, must be excluded from the room. The work should be done thoroughly or trouble with fogged paper is likely to ensue. Suggestions have been given at different times for tacking up sheets of brown paper and cloths over the windows as though any rough and temporary arrangement would serve all requirements. Under some circumstances these flimsy structures may do, but it is much better to have a reliable screen made, one that can be used with confidence and that will be always ready to perform its duty when called for. There is no need to have a heavy lumbering affair, for it may be constructed with hinges in the centre, so as to double up compactly for storing away.

The pattern of screen now given may not suit every window, but it will serve to give an idea of what is required. Alterations can be made in the details to meet any special shape of window or opening. It is a light framework of wood to be covered with cloth or manilla paper, and should fit inside the casing of an ordinary house window, close

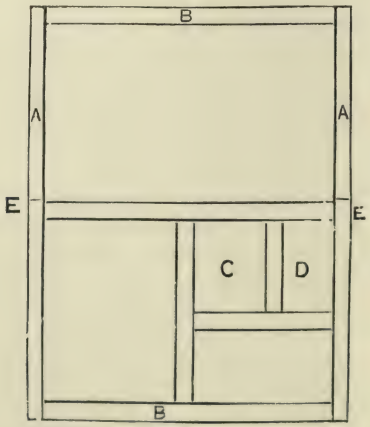


FIG. 1.

against the sashes. The crossbar in the centre should come against the junction of the upper and lower sashes, and if the window is one of four or more panes, the vertical centre-piece dividing the lower half ought to be over one of the window-frames. Almost any position that will keep the screen rigid will do for the cross pieces, so long as no part of the window frame comes opposite to opening **C**.

Obtain some lengths of wood, three quarters of an inch thick by two inches in breadth. First cut the two uprights marked **A**. Let them be about a quarter of an inch shorter than the inside of the window-casing, to allow for the cloth which is to cover the screen to be tacked on the edge, and for another strip of thick cloth or plush to be laid over in addition. Assuming that in place of this method of covering, it is thought sufficient to nail or glue the cloth to the

sides of the frame, the size must be increased so that the screen will fit closely in the casing. Now cut the top, bottom, and middle cross pieces **B B** quarter of an inch short of the full width of the casing. These should be joined together by halving where they meet as shown in the diagram Fig. 2 or by mortising if preferred. The two other pieces should now be cut, making allowance at the ends for the overlap. Their position will depend upon the size of the negative intended to be used opposite **C**. Make the space for the largest size likely to be wanted, adding carriers for the smaller sizes. The dimensions of **D** and the other openings are immaterial, but care must be taken that no part of the window-frame is allowed to come opposite the apperture **C**.

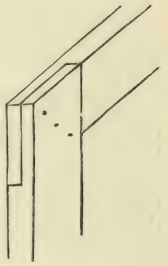


Fig. 2.

The screen may now be put together, and the joints made firm with glue and screws.

To make it more portable for stowing away when not in use, cut the two upright lengths **A A** at **E E** and fasten hinges on the side that is to be placed against the window. This will allow the screen to be folded into half the space it would otherwise occupy. A piece of wood may be put across as a stretcher if greater strength is wanted, but the hinges will hold the frame in position sufficiently.

The frame-work should be covered, except the spaces **C** and **D**, on both sides with black cloth or stout manilla paper. A cheap black cloth such as is used for linings will do, but it is not desirable to have too many holes in it, though these may be stopped by pasting black tissue or brown paper at the back. Fasten with tacks driven into the edge of the screen. Manilla paper such as direction labels are made from can be got from the stationery warehouses, and it is also sold as a black waterproof paper for packing purposes. It is extremely tough and makes an excellent covering material. Cut pieces, rather larger than the size of each opening, and attach with glue, rubbing the paper into close contact with the wood.

A strip of thick cloth or plush may be nailed all round the outer edge as packing, to ensure the exclusion of all white light, or to adjust any inequalities between the screen and window-casing.

Cover the aperture **D** with orange medium on both sides. This will allow a safe light to enter the room, and the operator will not be fumbling about in the dark.

Having the screen covered and almost complete, some plan for holding it erect and firmly in position must be adopted. The simplest method is to insert a screw about half way up each side, right through the screen and into the window-casing, but whatever arrangement is decided upon, it must be rigid, and free from vibration.

Just below the apperture **C** a projecting rib of wood must be fixed. The purpose of it is to receive and support the end of the board on which the camera will rest. A piece of wood about one inch square, screwed to the crossbar of the screen will serve. To obtain the exact position, place the camera opposite the opening, and allow for the thickness of wood intended as a base for the camera.

Baseboard for Camera.—The form most commonly used is that of a long board from four to six feet long, one end carrying the camera, and the other end the easel or board on which the paper is fixed. If small enlargements only are wanted, this arrangement is handy, but for large work it is not serviceable; the baseboard cutting off the rays of light. Certainly the difficulty can be overcome by lowering the baseboard, and filling up the space between it and the camera by inserting boxes, books, and such-like things, but this cannot always be performed with safety; there is a liability of creating vibration by these temporary fixtures.

A better method is to make a short baseboard to carry the camera alone, and place the easel on a detached table somewhat lower than the camera baseboard, or make a break in the level as indicated in Fig. 8. The form of support for the camera given in Fig. 3 is easily put together and is compact for putting away when not in use. It consists of two pieces of wood, **A** and **B**. **A** is about two feet

long and carries the camera ; it rests on the rib **C** at one end, and on **B** at the other. The length of **B** should be the same as from the top of **C** to the floor, if the baseboard is to be used horizontally. **B** is improved by having a piece cut out of the centre to form two feet where it touches the floor, so as to give it a steady footing. Both **A** and **B** may be fastened together by hinges if desired, or by two wire nails inserted through **A** into the edge of **B**. The attachment of **A** to **C** can also be made on the principle just named. The width of the two pieces of wood should be quarter of an inch broader than the camera base.

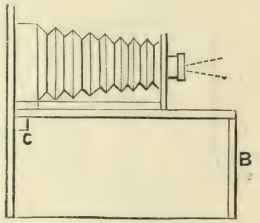


FIG. 3.

A small table of the right height, placed beneath the aperture, may be used as a baseboard, and makes an excellent substitute in place of the one previously mentioned, but it must be placed so as to stand firmly upon its feet.

Baseboard for the Easel.—A table or bench may serve for this purpose, in fact it matters little how the easel is supported so that its face is parallel with the front of the camera, and it is rigidly fixed in position. Whatever the form of support, it should be lower than the camera stand, so that when extra large pictures are being made, the centre of the disc of projected light will fall upon the centre of the easel. Some workers prefer to fasten two parallel lengths of wood along the top of the table or baseboard, to guide the easel as it is moved nearer to or farther away from the camera. A better arrangement, securing rigidity and smooth working is an adaptation of the bevelled lines referred to in connection with artificial light.

The Easel.—Almost any board with an evenly-planed surface may be used as an easel, so that it can be fixed parallel with the lens and negative. A cheap soft-wood drawing-board is very serviceable, especially when feet have been attached as FIG. 4. It can be moved about as

required. A sheet of smooth white paper should be pasted on the board, and if diagrams of the sizes in general use are made on its surface and centred with the disc of light, they will prove helpful.

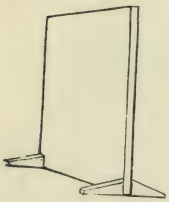


FIG. 4.

The bromide paper is fastened to the easel by a pin at each corner. Ordinare dressmakers pins are better than drawing pins for this purpose.

An addition to the simple form of easel just mentioned is sometimes made by placing a sheet of glass in front of it. The end sought by the introduction of the glass is to keep the sheet of bromide paper perfectly flat during exposure. The glass, if quite free from blemishes, has no injurious effect on the image; the only danger is that of breaking the glass itself. A slip of wood, rebated on the inner top edge, is fastened to the lower part of the easel; on this the glass stands. To the upper portion, a wooden turn button is attached to hold the glass against the board. Where only one size of enlargement is made this system is very convenient, for the sheet of paper is dropped behind the glass, into position in a moment, but when various sizes are worked, difficulties arise from the fixed rib on which the glass stands.

Another Form of Easel.—In place of the ordinary plain board, procure a large strong frame, something like a picture-frame, FIG 5. It should be made of oak, and fitted with a stout removable backboard planed very level, and covered on the faced side with white mackintosh, cloth, or paper.

Two upright pieces of wood are then made with a groove on the inner side to clip the frame, but allowing it to slide up and down between them. These uprights are bound together by a length of hard wood at the bottom and two pieces at the top; the latter allowing the frame to pass upwards between them. Feet are then attached to the sides, back and front.

A sheet of glass, free from defects is procured, and fixed with putty in the rebat of the frame. A bed of sheet rubber, attached by rubber cement may be used in place of putty.

The backboard is held in position by turn buttons fastened to the frame by screws, and should be made to press against the glass.

A thumbscrew having a flat end, and a nut to receive it,are now inserted into each side of the uprights, so that when the screw is turned, the end of it will press against the sliding-frame and bind it firmly. The nut should be let into the inside of the groove, flush with the wood.

At the bottom of each groove glue a small square block of vulcanized rubber, to act as a buffer in case the frame should fall by accident to the bottom.

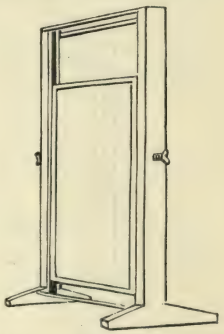


FIG. 5.

When the frame requires to be raised or lowered it should be grasped at the bottom, in the middle, by one hand, while the other hand works the screw. The apparatus is not difficult to construct, and its principal cost lies in the sheet of glass.

It will be readily seen that if the image is sharply focussed on the white backboard, and a sheet of paper is then inserted behind the glass and against the backboard, resting on the bottom of the frame, that not only is the paper held perfectly flat, but that the picture must be in true focus, because it has taken the place of the backboard. In addition to these advantages pins are dispensed with, the frame slides up or down at the will of the operator, and the whole arrangement is compact.

Another Form of Easel.— This requires a sheet of glass as the easel previously mentioned, but it dispenses with the sliding grooves and thumbscrews. The frame with its glass front are fixed permanently together, and feet are added to hold it erect. An old picture-frame with a good glass in it will serve very well for the purpose.

Its peculiarity lies in the form of backboard. This is divided into three sections, fastened together by hinges, and resembles the threefold back of a printing-frame, except

that the pieces of wood are placed lengthways in the frame. At the top and bottom of each division a brass or wood turn button is attached, a piece being cut from the side of the

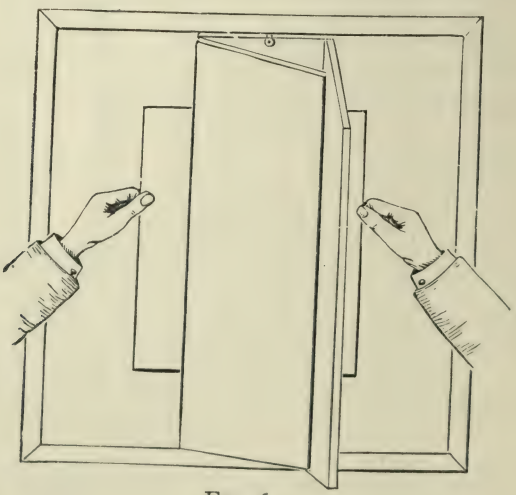


FIG. 6.

frame to receive the projecting end, thus holding the back firmly in position. The centre piece should be made narrower than the two outside lengths. The intention of this arrangement is to enable the operator to insert a sheet of paper and move it about to any position he desires within the frame, and to keep the sheet from falling when no longer held by the fingers (FIG. 6).

The upright centre of the back is first placed in position with a sheet of paper inserted between it and the glass, and the centre top and bottom buttons are turned into their respective grooves. The side pieces or wings are allowed to remain open. This enables the operator to lay hold of the sheet of paper projecting at each side so that he can raise or lower it as he wishes, the pressure of the middle piece holding it at any point. The sidewings are closed and

fastened, prior to exposing. If the face of the back-board is covered with a piece of coarse white calico, any liability of the paper to slip is avoided. Should the depth of the frame be wanting in space to allow the grooves to be formed to receive the end of the turn button, projecting bits of flat brass may be attached to the outside instead.

The Reflector.—When the camera and easel are placed diagonally, so that an uninterrupted view of the sky is obtained as in FIG. 8, there is no necessity for a reflector, but if the camera is placed horizontally and there are any buildings or trees opposite the window, the equal illumination of the negative can only be secured by placing a reflector outside the aperture containing the negative.

A piece of zinc, tin, or wood may be used for this purpose, though the first named is the best if it is to remain permanently in position, because it is neat and does not rust with exposure.

It should incline at an angle of from 45 to 50 degrees, but it is better to make it moveable from the inside as shown in FIG. 7. To do this, punch two holes on the lower end and another towards the top of the left-hand side. Into the two bottom holes twist pieces of wire so as to form a loose hinge, by which it is attached to the window-frame. Now fasten the end of a piece of copper wire to the hole in the side, and pass the other end through a hole made in the window-frame with a sprig-bit, so that the wire can be worked in or out from the inside of the room. Twist a knot on the inner end of the wire for safety. By adopting this method it will easily be seen when the illumination is at its best, and a simple pull of the wire will close up the reflector when out of use. The hole for the wire must not be too large, and should open inwards to admit a small wooden peg for the purpose of wedging the wire at any given point.

The form of reflector given in FIG. 7 illustrates how a small window let into the wall may be fitted, so as to close up the entire opening when enlargements are not being produced. An adaptation of this idea can be made to almost any window, large or small.

To ensure good illumination the size of the reflector should be several inches larger each way than the aperture in which the negative is fixed.

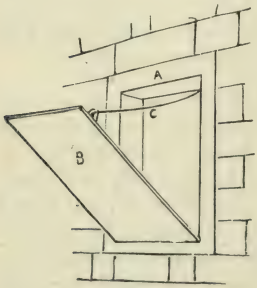


FIG. 7.

The true reflector is laid upon the sheet of zinc already described. Some workers prefer a sheet of pure white cardboard; others adopt tissue paper, or a sheet of ground glass. These are all commendable under certain conditions and will give good results, but a piece of white opal glass will be found excellent for the purpose. If paper is used it must be attached to the outer frame or there is danger of its being blown away in the middle of the exposure, and when any of the heavier reflectors are used, safeguards against dangers from the same cause should be adopted.

Dormer Light.—The illustration FIG. 8 shows how a dormer light may be utilized. It offers the important advantage of not requiring any reflector to secure uniformity of illumination. The end of the camera containing the negative is raised towards the sky, thereby avoiding irregular reflections from buildings or other objects that may be near.

The whole of the window, except the opening left to receive the camera end, should be blocked out by a screen constructed after the manner shown in FIG. 1.

A hood, projecting inside, and added to the sides and top of the aperture just referred to, will be found beneficial in excluding the light. The top piece of this hood should be fixed diagonally, at the same angle that the board carrying the camera is intended to be placed. Provision must be made for any projecting piece of mechanism connected with the camera sides, by cutting away the wood, so as to enable the apparatus to be inserted or withdrawn easily. A piece of black cloth thrown over, will then effectually exclude any stray rays of light that

may attempt to come through the chinks between the hood and camera.

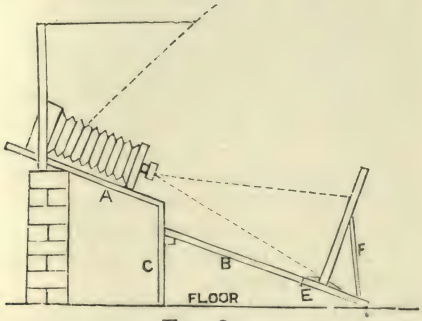


FIG. 8.

For enlargements of small dimension, the board for carrying the camera and easel may be made in one piece, but for large sizes, the method shown in the illustration is undoubtedly preferable. **A** and **C** may be attached together by hinges where they join, or a pair of wire nails may be driven through the end of **A** into **C**. In the same way **B** may be bound to the rib on **C**.

The easel face must be fixed to stand at a right angle with **B**, but as this throws it out of perpendicular, extra supports must be added to obtain thorough rigidity. A strut **F** consisting of a rib of wood, one inch by three-quarters, and attached by a hinge to the back of the easel, will afford the necessary help. The lower end of **F** should be pared thin and a series of notches made at short intervals along the centre of **B** to receive the point. If sufficient rigidity is not secured by this means, a small thumbscrew clamp, usually sold at 6d. each, may be used to bind the foot of the easel to the board **B**, as shown at **E**.

The negative, the lens, and the easel must be placed parallel with each other.

The Camera.—Any ordinary landscape or studio camera that will rack out sufficiently, will serve for daylight enlarging. Its purpose is simply to enclose the rays of

light passing through the negative, so that they may be gathered up by the lens and projected on the easel.

Sometimes, to relieve a valuable camera for other work, a special camera is constructed for enlarging. It embraces a bellows body with a plain wood frame at each end; one end carries the negative and the other holds the lens. The negative end contains carriers for various sizes of plates, and an arrangement for racking the lens backwards or forwards is provided, though this may be of the simplest character so long as stability is obtained. Should it be desirable to construct a camera for this purpose, the table of enlargements on page 12 will supply the distances required from negative to lens for the various sizes for which the apparatus is wanted.

The Lens.—The same instrument with which the negative was secured may be used for producing the enlargement. The only exception to this is when a lens of very short focus has been used. To adopt some other form of lens offers no practical advantage; for any weakness produced in the negative when it was obtained, such as being out of focus in the corners, distorted or leaning buildings, cannot be remedied by a new form of lens any farther than may be accomplished by using the original instrument. The latter weakness, viz., lines out of the perpendicular may be corrected by tilting the old lens just as well and perhaps better than by complicating the position by substituting another objective in its place. The first named weakness is beyond remedy.

A lens of unusually short focus, although offering flatness of field with ordinary work, tends to produce unequal illumination when used for enlargements. A medium length of focus is better.

Use the largest stop that produces sharpness at the corners of the enlargement. There is nothing to gain and everything to lose by stopping down beyond what is necessary. Remember that distant and near objects are not in the question, the image, such as the negative may present, being thrown upon a flat sheet of paper. Seek for perfect sharpness, with equal illumination all over the sheet.

Carrier for the Negative.—The usual methods employed for holding the negative in position at the end of the camera may be classified as follows :—

1st. Occupying the place of the ground glass.
2nd. Using the ordinary dark slides.
3rd. Inserting the negative in the window-screen.

Either of these can be adopted as may best suit the convenience of the worker.

The first named plan is easily performed by removing the two top corner attachments by which the focussing screen is held ; then slipping the glass out, and fixing the negative in its place. The advantage it presents is that projections at the sides are avoided.

In the second method, the negative is placed in one of the dark slides and both shutters drawn out and bent aside. This arrangement is not suitable if the end of the camera has to be passed through an opening as in FIG. 8 as the projecting shutters are in the way, but if the end of the camera is intended to be placed against an opening in the window screen there is no objection to it. With some forms of camera the focussing screen may have to be removed entirely.

When the third system is adopted, the edge of the aperture against which the camera is placed is rebated so that the negative will be sunk in the wood. Metal fingers are affixed, to save the negative from falling out.

Another plan is to construct a single carrier to take the place of the double dark slide, making the edge flush with the camera.

General Order of Operations.—For the sake of those who may have never seen an enlargement made, and who may reside in a district where practical assistance cannot be obtained, the various operations, up to the completion of the exposure, may now be glanced at in the order in which they occur.

Having placed the window screen and reflector in position, as already explained and illustrated in the diagrams, erect the platform on which the camera and easel are to stand.

See that everything has solid bearings, as the slightest vibration will spoil all the work.

The light coming through the aperture may be sufficient so far, but if no provision has been made in the screen for an orange or ruby light, a non-actinic lamp must be provided. Even the most rapid paper will bear a surprising amount of orange light without being affected thereby; but to be secure, place the lamp a few yards from the apparatus, and high up, to obtain a good distribution of light all over the room.

Now place the negative in the aperture of the screen, or the dark slides, or in whatever position it has been decided to use it, upside down and with the glass towards the light.

Fix the back of the camera with the negative to the aperture, and exclude all white light from coming in, except what passes through the camera, by a piece of dark cloth pressed well against and into the chinks. An old velvet focussing cloth will prove handy for this purpose.

Erect the easel in position opposite the lens. On the face of the easel, attach by pins at the corners, a sheet of stout white paper, the size of the bromide paper on which the enlargement is to be made.

Now rack out the lens, and bring the easel backwards or forwards as may be required until the image from the negative is sharp and of the right size. The negative must not be disturbed, as any size that may be desired can be obtained by moving the lens or easel as just described. A reference to the table of enlargements on page 12 may render assistance at this point. Remove and re-affix the sheet of paper if it is in the wrong position; it should centre with of the disc of light.

See that the corners of the projected image are sharp, and if not, introduce a stop in the lens to obtain the necessary sharpness. The whole of the picture should be equally illuminated. If there is any want of uniformity in this respect move the reflector by the wire attachment, noticing the effect produced. A large magnifying glass, held in the hand, will assist the focussing.

Now mark on the easel, with a pencil, the position of the sheet of paper, making a strong mark at each corner.

Having secured microscopic sharpness so far as that is attainable, with uniform illumination, place the cap on the

lens. Remove the plain sheet of paper and in its place attach either a test slip—particulars of which are given under the chapter on artificial light—or the sheet of bromide paper which is to receive the picture. Care must be exercised that the easel is not disturbed, or the picture will be thrown out of focus.

The exposure must now be made. Having previously decided upon the time, with a watch in one hand, remove the cap with the other hand, and at the expiration of the time replace the cap.

Let there be no marching about the room during the exposure. Stillness is golden at this part of the operation.

Make a note of the length of exposure, the time of day, the quality of the light, size of negative and enlargement, make of paper, and other particulars for future guidance.

The sheet may now be removed for development.

Exposure.—The length of the exposure to be given is governed by the following :—

1. The actinic value of the light.
2. The colour and density of the negative.
3. The focal value of the lens and its stops.
4. The rapidity of the paper used.
5. The relative sizes of the negative and enlargements.

As the first and second are extremely variable, and are affected by the conditions under which they are employed, no reliable data that would serve as a guide to others can possibly be supplied. Only past experience based on observation will prove of any practical use upon these points.

The three last named contributaries rest upon fixed quantities more or less. An idea of their values may be obtained, and should be kept for reference.

It will be seen that figures professing to give the correct time for exposures would be valueless. The half minute of one operator would mean five minutes to another. To make a trial slip is a simple matter, and it acts as a trustworthy guide.

Further notes upon exposure are given in a later section.

SECTION VII.

ENLARGING BY ARTIFICIAL LIGHT.

PERHAPS the most important argument in favour of enlarging by artificial light is that the illumination is more reliable than daylight. A record of the exposure that has proved correct with any given negative can be kept for reference, so that at any time a repetition of the exposure (with the other conditions) will reproduce the results previously obtained, and without the trouble of a trial slip.

In addition to the foregoing, the operation can be performed in the evening, or at any time of the year. The weather and the daylight may come and go, while the enlarger sings "But I go on for ever."

Apparatus.—A few suggestions with regard to the various forms and cost of apparatus that may be adopted by anyone about to commence making enlargements may be desirable.

In the first place, a complete instrument, containing lenses, illuminant, &c., in their proper positions, and specially constructed for enlarging, may be purchased. If the purse will afford it, this course is the best. It is ready for immediate work, and there is no trouble in obtaining

the correct fittings and distances. The cost of a lantern suitable for quarter-plate negatives is not very great, as will be seen by a reference to the dealers price lists.

It is not my intention to recommend any given maker as superior to all others; this would be manifestly unfair. Some are better than others, but my experience is that if a decent price is paid and the instrument is bought with a well known name on it, its performance may be trusted.

Should the cost of a complete enlarging lantern prove an unsurmountable obstacle, a compound condenser may be purchased, and the body constructed during spare time, utilizing an ordinary camera lens as the objective.

Another form of enlarging apparatus may be made which dispenses with condensing lenses. Where the size of enlargement required is not very great it will be found useful. Particulars are given in a later section.

A list would not be complete if the ordinary optical or magic lantern is omitted from the methods by which enlargements can be made. An amount of trouble is entailed by this plan, as the negatives need to be reduced to lantern-plate size before they can be operated with, or some portion of the image must be omitted. This is also dealt with more fully later on.

A glance at the different sections with their functions comprised in enlarging apparatus may be useful here, especially should construction be attempted.

The body or lantern is simply a covering to prevent the rays of light from escaping except in one given direction. It is also made to serve the purpose of holding the sections in their relative positions, though this is not a necessity. It is possible to arrange the fittings detached; the light being enclosed but leaving an aperture through which it may act, and a simple cloth being thrown over the whole to prevent the light straying. This plan is not advised, and is only mentioned to explain the true requirements of the apparatus.

The order in which the fittings occur is: the light with its reflector, the condensers, the negative carrier, and the objective lens. Collectively and encased these are termed an enlarging lantern or camera.

The Illuminant.—The more concentrated and intensely white the light can be got, the better it will serve its purpose. Indefinite marginal rays are of no value, as they produce unequal illumination; so that if they can be cut off, their absence is a positive gain. Strive after a compact bright light.

The illuminant should be adjustable with regard to distance from the condenser, and arranged so that the light can be accurately centered, equality of illumination depending largely upon the proper regulation of these points. When the light is too near the condenser a dark patch is produced in the centre of the enlarged image. If the light is removed too far back, the margin becomes chromatic and useless.

Oil is mostly employed. It is not the best illuminant, but in positions where gas cannot be attached, it proves very serviceable. The objections to it are that unless care is exercised the flame is liable to variations in intensity, the wick gives trouble, and the replenishing of the oil vessel needs frequent attention.

Use a good quality of oil. The addition of half an ounce of camphor to a pint of paraffin oil reduces any unpleasant smell, and in the opinion of some workers increases the brilliancy of the light.

Double and treble straight wicks, placed endway to the condenser, and also circular wicks, are used. I prefer the latter. An addition to circular burners has been introduced of late, being applicable both to oil and gas, and it enhances the light value very materially. A piece of metal with a T-shaped end, is placed in the middle of the opening through which the air passes up the centre of the flame. When this attachment is absent, it will be seen that the lower part of the flame is much brighter than the upper portion; the cause being that only the bottom part of the flame receives a proper supply of oxygen from the atmosphere. When the T-shaped piece is added about halfway up the flame, it turns additional oxygen outward, into the upper portion of the light. The result is that the light becomes uniformly bright, securing greater equality of illumination.

House gas may be used with advantage in place of oil. The light is more uniform, and there is no trouble with the trimming of wicks or replenishing the oil.

Although the early form of argand burner has been superseded, it will be found very servicable, while the more modern burners already referred to are better still. Compared with a powerful circular wick oil lamp, the exposure is not much different when coal gas is used, but there is a considerable gain in steadiness of light and convenience. After deciding upon the form of burner to be adopted, oil is easily replaced by gas, by attaching a rubber tube to the nearest gas bracket.

The albo-carbon is a new light having many advocates. Ordinary house gas is impregnated with carbon, passing through a small chamber for this purpose, before reaching the burner. It emits a very bright light.

Another illuminant based upon house gas is the incandescent mantle recently introduced. It is very powerful and is the nearest approach to lime-light. The gas passes through a Bunsen burner around which a mantle is placed; impinging on the mantle it produces a steady white light of intense brilliancy. It is an ideal illuminant for enlarging, as there is an entire absence of flickering or inequality of light.

The lime-light offers an excellent illuminant for producing enlargements. For strongly developed negatives it is "just the thing," and requires a very short exposure compared with the forms of light previously named. It may be easily fitted to nearly any form of apparatus.

A spherical reflector of correct shape placed behind a weak flame tends to strengthen the rays that fall upon the condenser. The reflector should conform to the segment of a circle, having its centre at the point of light. Some reflectors are positively injurious; they disperse the rays beyond the margin of the condenser and cause imperfect illumination.

If the flame is brought in close proximity to the condenser there is a danger of the heat producing a fracture of he glass. The lenses forming the condenser being thicker in the middle than at the edges, a sudden increase of heat

at the centre may create unequal expansion and consequent damage; but apart from the risk incurred, the near approach may cause a loss of light, though intended to increase it.

The Condenser.—The end sought by the introduction of the lenses forming the condenser is to secure equal illumination and to produce greater brilliancy. It collects the divergent rays of light from the source of illumination and converts them into a system of convergent rays. These pass through the negative and being focussed by the objective lens, are projected in an enlarged form on the easel.

The modern form of condenser is that of two plano-convex lenses united by a mount, with the convex sides turned towards each other. Another form is sometimes met with, consisting of a double convex united with a plano-convex. It is a more expensive combination, but is preferred by many experienced enlargers.

The condenser must be of larger diameter than the diagonal of the negative it is to serve, or the corners of the image will be cut off. Thus, for quarter-plate negatives a five and a half inch condenser will be required, and so on.

If a condenser of larger diameter than eight inches is used, a smaller plano-convex lens should be introduced between it and the light, for the purpose of shortening the focus of the combination and so secure a greater intensity of illumination.

The Negative Carrier should be rebated on the side next the light. This will be found useful when the negative to be enlarged is indistinct and bad to focus. A specially sharp negative may be kept for focussing purposes, and when the correct distance has been obtained by its use, the negative proper, may be substituted for it. If the rebating of the carrier is on the reversed side to the light, there is danger that the focussing of the two negatives may not be coincident, because of the difference in thickness of glass.

The Lens must be carefully centered with the illuminant and condenser. Regulate the distance of the objective lens in conjunction with the illuminant. As the former is placed farther from the condenser, the illuminant should be brought nearer, and *vice versa*.

A rapid rectilinear lens is suitable. It works at a large aperture, and is free from distortion.

A good portrait lens may be used, and will produce an evenly-defined image, when slightly stopped down.

A very wide angle lens produces unequal illumination.

Do not stop down any farther than is necessary to secure sharpness in the corners. Beyond this, the illuminating power of the light is sacrificed.

Guiding Lines.—These are intended to carry the lantern and easel, the base of each being made to clip the bevel. The backward or forward movements are greatly facilitated, especially if the apparatus is large and heavy, and the faces of lens and easel are always parallel with each other.

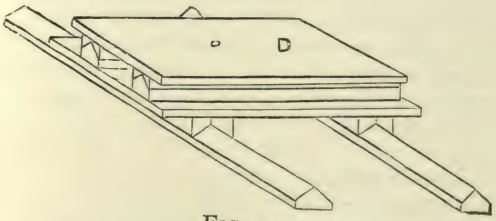


FIG. 9.

They constitute a great improvement on the primitive slips of wood nailed along the edges of a flat board hitherto used, allowing the apparatus to wriggle about from side to side, or wedge itself up at one end as the wood shrinks irregularly.

The arrangement consists of two slips of hard wood, shaped as **A** in section FIG. 10. These are laid—parallel to each other—on a table, and bed themselves by the weight that is placed on them. Four short pieces of wood **B B** are planed to the same bevel and attached in pairs to the bottom of the lantern or a piece of wood on which the lantern may be placed. **C** illustrates how the screws are sunk to avoid all

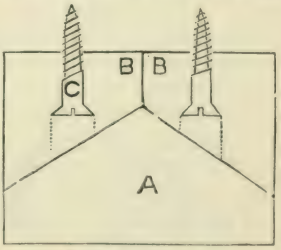


FIG. 10.

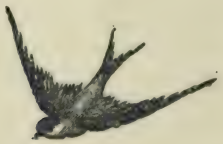
friction. The strength of wood depends on the weight of the apparatus intended to be carried ; the size shown in FIG. 10 will be sufficient for half-plate lanterns. The base lines need not be more than a yard or so long, if used for lantern only, as being laid loose on the table they may be moved to any position. A little powdered blacklead laid on the lines will enable the apparatus to slide along with the greatest ease.

An additional side movement may be introduced on the same principle. See FIG. 9.

Cap for Lens.—It is a great convenience to use a cap having a circular piece of orange or ruby glass let into the end, and allowing a non-actinic light to be thrown on the sheet. The material dealers will make them to order if the diameter of the lens flange is sent. Or an ordinary cap may have the end cut out to allow a circular piece of glass to be bound by the leather in position. To make leather pliable soak it in water or flour paste. Where the leather is wanted to over-lap and join neatly, pare the edge down to a thin bevel by a sharp shoemaker's knife held at an acute angle.

A ruby lamp placed on a shelf at some distance from the easel, and throwing a non-actinic light about the room, will save a lot of damage.

The easel, and hints on the order of operations are fully dealt with under the section on Enlarging by Daylight.



SECTION VIII.

EXPOSURE.

A CORRECT exposure is of fundamental importance. The extent to which under and over-exposure are controllable in the development is limited, and when that limit is passed, evil effects will be seen in one form or another. The print will be wanting in an effective balance of light and shade and those qualities that afford pleasure to the eye, or the colour will prove unsatisfactory.

The end sought by the exposure is to so affect the sensitive bromide paper by the actinicity of light, that the latent image when developed will exhibit the lights and shades with all the intermediate gradations of tone that are possessed by the negative, but in reversed order.

Although the negative provides the pictorial basis of the image, the lights and shades may be emphasized by varying the exposure in conjunction with the development.

Exposure by a strongly actinic light produces a different effect to that caused by a weak light, although the exposure to the latter be prolonged until of comparatively equal value with the former, so that depth and softness of tone are to some extent influenced by the intensity of the light employed. The penetrating power of a weak light is so restricted by a strong negative that an exposure, however prolonged, is unable to produce the vigorous effect to be obtained by a more intense illuminant. But if the latter is applied with a thin negative, the proper gradation of the tones is imperfectly rendered, and a flat image is produced; or, if the negative is weak in the shadows, the detail in them becomes obliterated.

Usually, a thin negative should be exposed to a weak light, and a strongly developed negative to a strongly actinic light.

Exposure and development are closely connected, one affecting the other (see development). As an instance, when eikonogen development is employed, the exposure may be reduced by fully one-third of that required for ferrous-oxalate.

Increase of distance from the source of light, either by the use of a lens of longer focus, or by enlarging to greater dimensions means increase in the length of the exposure.

The duration of exposure between one size of image and another—from the same negative and using the same illuminant—is altered at the same ratio that the surface is increased or decreased. By obtaining the number of square inches in each of the two sizes, and comparing their relative values, the difference in time is readily obtained. Thus, a 10 × 8 negative contains 80 square inches, while a 15 × 12 contains 180 or $2\frac{1}{4}$ times the area, and would demand $2\frac{1}{4}$ times the exposure given to the 10 × 8. The light rays are distributed over a greater surface, and—to put it simply—having more work to do, they require a proportionately longer time to do it in.

The state of the negative, its colour and density are important factors in deciding the length of the exposure. The values of artificial light, paper, and the developer are to some extent fixed quantities, and at least an approximate idea of their value may be known. If it were not for the negative introducing a variable element, it would be an easy matter to build up a series of exposures that would simplify this part of the operation, but as almost every negative has a light-resisting value of its own, produced by colour, density, or both, the idea of supplying a fixed rate of exposure is entirely out of the question. Every negative will require to be tested on its own account.

The length of time required for exposure presents great diversity. A thin negative, used in a good oil lantern, may require only one or two minutes, while a dense negative may need twenty to thirty minutes. The negative that requires a medium exposure usually contains better gradation in the half tones.

As illustrating this phase of the work, the following exposures, given by members of a large photographic society, with the society's lantern (11 inch triplet condenser), may prove interesting. The same apparatus was used by all, and the particulars, including the results, were added by the operators. on a sheet of paper provided for the purpose. Only two sizes of negatives and paper are represented here for the sake of ease in comparison. Three forms of illuminants are indicated. As may be expected, the negatives were produced by different methods of development, and consequently would present a wide diversity in colour. This, and the difficulty of describing the state of the negative, will largely account for the extreme variety in the lengths of exposure given.

Size of Neg.	Size of Enlargement	Stop in Lens	Illuminant.	Paper	State of Neg.	Exposure given	Results
¼ pl.	15 × 12	*f*11	*	Rapid	Medium	20 min.	Under-exp.
,,	12 × 10	*f* 9	*	Slow	Very thin	3 min.	Good
,,	15 × 12	*f*11	*	Med.	Medium	30 min.	Correct
,,	,,	*f*22	*	Rapid	,,	20 min.	Good
½-pl.	,,	*f* 9	*	Slow	,,	60 min.	Excellent
,,	,,	*f* 9	*	Rapid	Thin	7 min.	Right
,,	,,	*f*16	*	,,	,,	5 min.	Under-exp.
,,	,,	*f*11	*	,,	,,	4 min.	,,
,,	,,	*f* 9	*	,,	Dense & clear	2 min.	Much under-exp.
¼-pl.	12 × 10	*f*16	†	,,	Dense	5 min.	Good
,,	,,	*f*16	†	,,	,,	6 min.	,,
,,	15 × 12	*f*22	†	,,	Medium	20 min.	,,
½-pl.	,,	*f*16	†	,,	Dense	60 min.	,,
,,	,,	*f* 9	§	,,	Clear	4 min.	Satisfactory
,,	,,	,,	§	,,	Dense	4 min.	Good
,,	,,	,,	§	,,	Medium	3 min.	Excellent
,,	,,	,,	§	,,	Thin	5 min.	Over-exp.
,,	,,	,,	§	,,	Very thin	1 min.	Good
,,	,,	,,	§	,,	Sky film	15 sec.	Right

* Circular Wick Oil Lamp. † Early form of Argand Gas Burner.
§ Fourness Gas Burner.

Trial-slip.—Cut a slip for this purpose from the edge of the sheet of bromide paper that is to be used for the enlargement. There is usually an unoccupied margin that will serve as a test slip.

To distinguish the face, run a zig-zag pencil mark along the back from end to end. Thus, the plain side will be always recognised as the face.

Having focussed the image sharply on the easel, tear the slip into two pieces, one longer than the other. Fasten these slips with pins, face outwards, in such a position that each will embrace some part of the strong high-lights as well as a portion of the heavy shadows. Sometimes it is advisable to divide the slip into three pieces of different lengths, to operate over a wider extent of time. If it is understood that the shortest strip of paper is to receive the shortest exposure and the longer slip the longest exposure, there will be no necessity for adding any other marks or getting into confusion as to what each slip represents.

The exposures, using an ordinary negative enlarged to about three diameters, may be given of:—For daylight, three-quarters of a minute and one minute, and for a good oil light five minutes and eight minutes. These figures are only to give a rough idea, as the colour alone of a negative may more than double these times, to say nothing about the light, the value of which is unknown.

The slips should now be developed, using the same strength of developer that will be employed when the full sized sheet of paper is exposed.

The time that the image takes in appearing should be noticed, as indicating the value of the exposure for the deepest shadows.

From the evidences presented by the trial slips an idea of the correct exposure may be obtained.

Local Exposure.—Extra exposure may be given to certain portions of a picture calling for it. Over-dense patches, or slight stains in the negative, would be represented by almost blank spaces on the print, with an exposure that is sufficient and correct for the other portions of the image. Light drapery, a white-washed cottage, roofs, &c., are greatly improved by this extra treatment.

After giving the exposure for the picture as a whole, put the cap on; take a sheet of thin cardboard, or a stout piece of brown paper, rather larger than the sheet of bromide paper; tear a hole in the cardboard somewhat less than the place it is to be worked over, and in such a position that when the cardboard is held up, a ray of light will pass through the hole and fall upon the part requiring the extra exposure, the other portions being shielded from the light by the card. Usually the hole in the cardboard is best if left with a ragged torn edge. Hold the card rather near to the easel, take off the cap, and during the whole of the extra exposure keep the shield continually on the move, or the effect will be patchy. Much of the detail in a white dress may be made to reveal itself by this treatment. A cap with a ruby or orange glass end will be found of value when testing the size of the opening in the shield. If the hole is too large or wants modifying, gum a piece of brown paper to the edge to form the proper shape.

Where some portion of the image is extra thin, as the shadows beneath a clump of trees, and the exposure necessary for the entire scene would overwhelm the faint details in the shadows, a cardboard shield may be used as a protection during some part of the exposure. Tear the card making a rough edge something like an outline of the part to be shielded, and keep it constantly moving to avoid any objectionable markings.

A weak sky may be held back by similar treatment, a better sky being printed in afterwards from another negative by a second exposure.

Clouds and Skies.—A blank space professing to represent the sky in a landscape is both inartistic and unreal. Occasionally, nature does present us with a sky on which "not a cloud is seen," but it is never a white-washed vacancy; she fills it in with delicate tints, breathing harmony over the entire scene; the sky is never a blank. The absence of an atmosphere may pass unnoticed in a small sized print, such as quarter-plate, but the error becomes prominent in an enlargement, giving it a crude bare aspect. An examination of the pictures at many of our recent exhibitions shows that the weakness is being contended with, and is being overcome.

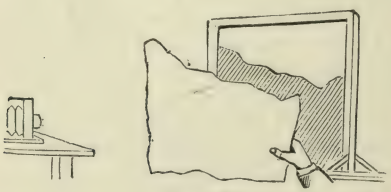


FIG. 11.

Frequently, clouds are already in the negative, taken along with the scene, but the sky is too dense to allow the light to penetrate the negative and affect the paper. A prolonged exposure to the sky—shielding the landscape as in FIG. 11—may overcome the difficulty.

It may be necessary in the generality of cases to make a second exposure from a suitable sky negative. Proceed as follows :—

Spot out any imperfections in the sky of the view negative, with a fine camel hair brush dipped in water colour; then insert it in the carrier and make the exposure in the ordinary way, just as though the second exposure had no reference to the matter.

If the sky in the view negative is thin, it may be shielded by a piece of brown paper kept moving during the exposure, but the paper must not be allowed to pass over the objects standing against the sky. In the majority of negatives the sky is sufficiently dense without this protection.

Before removing the first negative make a strong pencil mark on the edges of the bromide sheet, to show where the land ends and the sky begins. These marks are to act as a guide when using the shield in connection with the second exposure.

Having torn one side of a piece of cardboard to a rough outline of the view (taking no notice of trees and distant objects that break through the skyline, as the sky will not show on them), remove the first negative and insert the cloud negative—upside down as before. The lens must be capped during this operation.

Now make the second exposure, holding the cardboard shield over the lower portion that has already been acted on by the landscape, and keep the cardboard moving as before. The side pencil marks will show distance below which the

shield must not go. This second exposure will be much briefer than the first exposure. Clouds only require to be faintly printed, or they will produce the appearance of an overcast sky, and impart a heaviness to the scene. A light tint is all that is needed. The sheet may now be developed.

A test slip should be made from all cloud negatives, and as they may be required frequently, the slips should be pasted in a book for future reference, and the time of exposure and all other particulars added underneath.

In deciding upon the cloud negative to be used, observe that the character of the sky is in unison with the picture, and that the lighting of both cloud and scene are from the same side. A view, exhibiting the rays of sunlight coming from one side, and the clouds showing that the light comes from the other side, is a sin against truth.

Cloud negatives on paper or flexible films are useful in connection with enlarging, as they may be printed from either side, thereby adapting themselves to the lighting of the scene. The film should be fastened at the margins to a sheet of glass by gummed paper, or they may be inserted between a pair of thin glasses bound together at the edges.

Over-exposures.—Their general tendency is to reduce the contrasts and brightness of a picture. The prolonged action of the light penetrates and absorbs the faint half tones, shorn of which the print becomes flat and heavy looking.

The purity of the blacks is also weakened, a brownish tone being acquired, especially with hydroquinone.

Slight over-exposure is preferable to under-exposure, especially if the negative is a trifle hard.

Under-exposures produce harsh and crude prints. There may be plenty of black and white, but the intermediate tones are absent and a chalky appearance is imparted to the high lights. Sometimes an effect of snow in place of sunlight is produced, like that occasionally seen in hard transparencies thrown on the screen.

Hardness is the prevailing fault in many of the enlargements usually seen, and requires to be more guarded against than any other. While an amount of vigour and contrast is desirable, it must be accompanied by a series of graduated

half tones pervading the entire scene, and blending it together as a harmonious whole. The high lights in a landscape that may be allowed to be pure white must be small, an insignificant portion of the whole, and should not be far removed from the foreground.

A Thin Negative.—Use a weak light if the negative is uniformly thin, and give a rather short exposure, otherwise the high lights and half tones will be flat and the print lack vigour. The actinic power of the light may be reduced by placing a small stop in the lens. Follow the short exposure by an energetic developer, or at least one that is strong in accelerator.

A Dense Negative requires to be fully exposed to a powerful light and should be followed by gradual development. If the negative is wanting in contrasts an extra proportion of restrainer will be needed.

SECTION IX.

VIGNETTING.

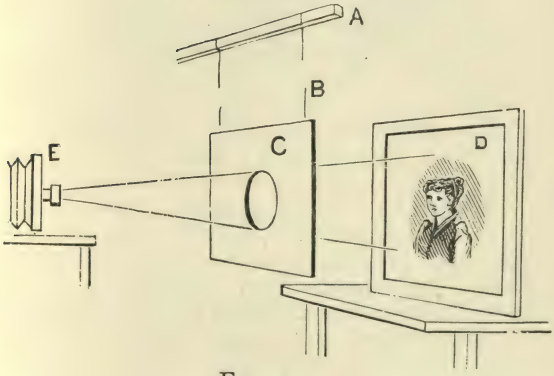


FIG. 12.

VIGNETTING is accomplished by means of a sheet of cardboard held or suspended between the lens and the sheet of bromide paper. An aperture is made in the centre of the cardboard, through which the cone of diverging rays bearing the image or some portion of it, passes before reaching the easel. During the time of exposure the vignetter is allowed to swing backwards and forwards, with a gentle motion, like a pendulum.

A stout board with long cords will oscillate a much longer time and perform its work better than a light board with short cords; and the nearer the vignetter is brought to the lens, the softer will be the gradations of the vignette.

There is no necessity to use more than one board for each size of enlargement, as the aperture in the centre may be modified to any given shape by smaller vignetters, cut out of thick non-actinic paper, and attached to the cardboard by pins or gum.

The aperture in the vignetter need not be serrated on the edge, and should be small in comparison to the enlargement, because it will usually be placed within a short distance of the lens.

The illustration given almost explains itself. The rod **A** is placed high up, over the space between the lantern and the easel, and projecting from the wall at a right angle. It should not be a fixture, but arranged so that it may be moved nearer to or farther from the lens. A slip of inch wood, fastened to the wall, and containing square or round sockets at intervals of two inches, to receive the end of the projecting rod, will enable this alteration of position to be performed readily. The vignetter **C** is hung by two cords **B** to the rod **A**. A pair of holes may be punched into the top margin of the vignetter for this purpose. **E** shows the position of the objective lens projecting the rays of light indicated by the two diverging lines, through the vignetter to the easel **D**.

A piece of copper wire stretched across the room, may be made to serve in place of the projecting rod, shown in the illustration, but the latter is by far the best arrangement, being easily adjusted, and when not in use can be reared in a corner of the room until wanted again.

Serves Another Useful Purpose.—By an adaptation of the vignetter, the operator may enlarge a single figure forming part of a group of figures, or obtain an enlargement of any given feature in a view. Form the aperture so that only the portion of the image that is required to be enlarged will be projected on the easel, the vignetter acting as a screen and cutting off the rays from such parts as are not wanted. A gentle motion may be given to the board should a soft margin be desirable. When no other portrait exists of a deceased person except that forming part of a group of individuals, this arrangement will be found useful.

SECTION X.

SOAKING.

BEFORE development, the sheet of bromide paper that has received the exposure must be immersed in clean water for one minute at least. Unless this is done, the developing solution may produce chemical fog, degrading the whites of the print. By saturating the emulsion with water the development is started gradually and uniformly over the entire surface.

The sheet of paper should be passed into the bath of water at one end, face up,—two corners of the sheet being laid hold of so as to draw it through the water briskly. The other two corners should then be pressed down to get a body of water on the surface, and the sheet drawn back again, and turned over; after which it may be left face down in the water for one minute. The reason for this action is to ensure all air bubbles being swept away, and to secure the equal saturation of the paper back and front. The sheet should then be laid face up in the developing dish.

With ferrous oxalate development some workers prefer to put a few drops of a 10 per cent. solution of acetic acid in the soaking water to obtain pure whites, but it has the tendency to make the print chalky if the exposure has not been full.

SECTION XI.

DEVELOPMENT.

DEVELOPMENT is the chemical process by which the latent image produced by the action of light during exposure, is made to reveal itself. The silver embodied in the emulsion on the paper undergoes a change proportionately as the transmitted light is able to penetrate the negative. This change, controlled by the exposure, prepares the silver for a further change by the developing solution, viz., that of reduction to a metallic state, in which the image becomes visible.

It is obvious that a very close relationship exists between exposure and development. One is influenced by the strength or weakness of the other, thereby affecting the colour and general appearance of the image produced. By taking advantage of the connection between the two operations a means of obtaining a contrast or softness in the enlargement or of overcoming a weakness in the negative is secured.

Examples.—If two exposures are made from the same negative under identically similar conditions, one being developed by a strong solution and the other by a weak solution, the former will develop quickly and present a deep tone in the image with strong contrasts, while the latter will develop slowly and exhibit a softer tone, and therefore with less contrasts.

Let us suppose that the same negative is now submitted to two different exposures—neither being strictly correct—one is of short duration, the other is prolonged and the same development is applied in each case. The longest exposure will develop quickly and must be removed from the bath without delay to save it, but the tone of the image will be weaker than that of the short exposure which has had to undergo a slow and perhaps tedious development. A very slow development is not usually desirable, as there is a risk of the paper being stained, and the tone undergoes a change, losing its freshness.

Now take the same negative, and submit it to a correct or full exposure with a weak light such as is provided by an ordinary oil lantern. Then, taking away the oil illuminant, replace it by a lime-light, and give a proportionately short but correct exposure. Applying the same developer to each we should discover that while the time required for development would present very little difference, the tone produced by the strongest light would be deeper, and exhibit greater contrasts than the other.

In the foregoing instances we have been dealing with a normal negative, so as to indicate the relationship between exposure and development, but when thin or dense negatives require to be operated with, a different course will have to be pursued.

A uniformly thin negative should be subjected to a weak light, and receive what may be termed a slight under-exposure if the vigour of the high lights is to be preserved. Follow by a strong developer, to counter-balance the under-exposure. An increase in the accelerator must be accompanied by additional restrainer. The image may be slow in appearing, but will gradually acquire depth of tone.

A dense negative that is wanting in contrasts will require a reverse treatment to that just named. Exposure to a strong light, followed by a weak developer containing a slight excess of restrainer will meet the wants of the case.

Ferrous oxalate calls for special care in making these variations in the developer; eikonogen allows a wider latitude without the risk of damaging the colour of the print or the paper.

Preparatory Hints.—Success in making enlargements is greatly influenced by attention to the apparently trifling details that surround the operations. A good negative, correct exposure, and the best developing formula may be all undermined by neglect of some minor detail, which once pointed out would ever afterwards be rectified. Some of these, connected with development, may now be indicated.

Dishes and measures should be scrupulously clean. Rub them well with a flannel and monkey brand soap, and finish off with plenty of clean water. Washing soda or even hydrochloric acid may be used to remove stubborn stains. Keep a dish specially for developing if that can be managed.

Don't touch the hypo bottle until the print is ready for fixing. Hypo is a prolific source of stains and imperfect work. If it must be meddled with, exercise care, and wash the hands thoroughly prior to commencing operations.

In handling the bromide paper avoid touching the surface. Ferrous-oxalate is very susceptible to perspiration from the hands.

The effect of temperature on developing solutions is considerable. In cold weather the chemicals have a tendency to recrystallize, and development proceeds very slowly. Pour warm water into the developing dish before using, to take the chill off. Place the bottles containing the developing solution in a warm room some time before they will be required, and shake them up well. The temperature should be about 60° but never beyond 70° Fahr.

Prepare the developer during the soaking of the paper (not before), or if the enlargement is to be treated with old developer first, mix the fresh solution while the old is operating. Long exposure before use, weakens the power of the developer; it absorbs the oxygen from the atmosphere, and gradually loses its vigour. Therefore, the fresher it is, the better its action can be relied upon.

The Operation.—When the sheet of paper has been soaked sufficiently, place it, face up, in the bottom of a clean dish for development. Pour on the developer from the measure in which it has been previously mixed, using a sufficient quantity to flow from side to side as the dish is rocked. The emulsion is already saturated with water,

which assimilates with the developing solution, and gradual development of the image takes place. See that every part of the sheet receives its share of the solution. When the development is uniformly complete, with a correct gradation from shadows to high lights, the sheet may be removed to another dish for clearing; or the developing solution may be poured off into the measure, and the clearing solution may be applied in the same dish that has been used for development. (See Section on "Clearing.")

If, during the operation, it is seen that the image is almost complete at one side or part of the sheet, while the other portions are very backward, run the solution off the advanced portion, by tilting up the dish, and allowing the full strength of the solution to remain only on the part requiring the extra development. The almost complete part of the image may have received sufficient of the developer without applying any more, but should further progress be desired, it is a simple matter to flow the solution over again. Thus to some extent, the backward parts may be brought forward, and the finished portions restrained from further development.

A method of stopping the action of ferrous-oxalate developing solution is to apply a camel hair brush dipped in acidulated water, to the part requiring it. Water alone will serve for the other developers, though some workers prefer acid in it. After dipping the brush in the acid water, squeeze the moisture out again with the fingers, and pass the brush over the place. This will absorb the developing solution on the surface of the paper, and is better than applying a lot of moisture with the brush. Acidulated water effectually stops the development so that it cannot be started into action again, but as water only need be used to stop hydroquinone, eikonogen, and hydroxylamine, a second application of the developing solution may be effectually made in most cases.

SECTION XII.

DEVELOPERS.

EACH developer, whether ferrous oxalate, eikonogen, or any other, has its own pecularities, and it is only by working in accordance with them that the best results can be expected. They are oxidizing substances in common, but their action when producing the tone of the image is dissimilar to each other, and they are susceptible in various degrees to influences outside themselves. In addition to the colour forming chemicals, the compound solutions embrace various salts that are intended to perform some special function in the development, and it is important that these purposes are comprehended, or when difficulties arise, it will be impossible to deal effectually with them. To follow some highly lauded formula is not sufficient, the worker should endeavour to know the "Why and wherefore."

Much of the following information will of necessity be an old story to experienced operators, but they must remember that there are new beginners in the field who have not years of practice to fall back upon, and to meet the wants of these, simplicity of language and terms will be employed.

The Developing agent is the substance that oxidizes and reduces to a metallic state the silver in the emulsion with which the surface of the paper is coated. It is represented by the iron in ferrous oxalate, and in the other developers by eikonogen, hydroquinone, and hydroxylamine.

Neither the alkali nor the bromide impart colour to the image, though they may affect and alter the tone of it; the real colour-producer is the developing agent.

Only in the presence of another salt does the developing agent practically act; it needs to be energized, or, as it is mostly termed, accelerated, to perform its office. The fact that a picture is slow in making its appearance is rarely the fault of the developing agent. If the exposure has been correct, the failing will usually be discovered in the accelerator or the restrainer; either the alkali is too weak, or its power has been unduly neutralized by bromide.

By increasing or reducing the proportions of the developing agent as compared with the water in the solution, the colour of the image may be made either deeper or lighter, much as water colours may be prepared for either washes or deep tones by the addition of more water or more of the colouring matter. Of course, the tone is also affected by other interfering agents, such as the time of exposure and the other chemicals that are necessary in the solution as already referred to, but they only occupy a secondary position.

The Preservative.—All the developing agents require to be preserved when in a state of solution. For this purpose acids, as citric and sulphuric are added to the iron, and sulphite of soda or acid sulphite of soda to eikonogen or hydroquinone.

These preservatives also assist to restrain the alkali from running away with the development before depth of colour has been secured, and to that extent they act in conjunction with the bromides. Although ordinary sulphite of soda is used as a preservative, it is occasionally found to possess an amount of alkalinity, which requires to be neutralized by the addition of acid.

Acid sulphite of soda being already impregnated with acid, is a much more powerful restrainer than sulphite

of soda; therefore a less quantity is required. The correct proportions of these preservatives are given in the formula pages of formulæ at the end of the book.

The Accelerator or alkali stimulates the developing agent into action. The carbonates and hydrates of potash and soda are usually associated with eikonogen, hydroquinone, and hydroxylamine.

The neutral oxalate of potash used in the iron developer is not an alkali. On combining the solutions a double salt is produced, which imparts energy to the developer.

"A good servant but a bad master" may be applied to the accelerator. If used in excess or free from the restraining influence of some other substance, it flashes the whole picture up before the shadows have acquired solidity, producing a superficial image, full of detail, but wanting in depth of colour and altogether lacking in contrast. The end to be sought by its use is the gradual reduction of the silver in regular order, beginning with the deepest shadows and proceeding onward through the intermediate tones towards the high lights, strengthening those parts of the image first visible during the whole process. To obtain this steady building-up of the picture a restrainer must be added, or the alkali must be adjusted to such a proportion that its action is under control and not hurried. With the ferrous oxalate developer, bromide or the use of old developer, which also acts as a restrainer, is a necessity, but when eikonogen or hydroquinone are used, bromide may be omitted, although the addition of a few grains is often preferred.

When wrongly used the alkali is a prolific source of stains and fog, affecting portions of the paper that have not received any exposure. These imperfections are liable to appear even when a normal developer is used, if through too short an exposure, the development is unduly prolonged. They usually commence at the margin and spread inwards over the sheet, degrading the whites into greens and greys. Although the progress of this chemical fog may be often arrested by a little bromide, the proper remedy is to give a longer exposure. Instructions for the removal of stains are given elsewhere.

The Restrainer.—The bromides of potassium or ammonium are generally used, or in place of these, old developer may be employed.

The useful work which the restrainer performs in controlling the accelerator and preventing chemical fog on the unexposed portion of the sheet has been referred to in the preceding paragraphs, but its action extends farther than simply causing the development to proceed slowly; it affects the high lights, keeping them pure and bright. In some cases this is an advantage, as when the negative is wanting in vigour, or the exposure has been excessive; it places a power in the hands of the operator, which, if rightly used, may enable him to correct these failings to some extent.

The addition of one or two drops of bromide to a ferrous oxalate developer, under the conditions named, will have a beneficial effect on the print, but only just sufficient to keep the highest lights from toning should be used, or a hard picture will be produced. Some operators dispense with bromide in the iron developer, and use old developer in its place.

Rough surfaced papers require more bromide than smooth surfaced paper, as they are more inclined to exhibit chemical fog.

Old developer is one of the best restrainers, although not so powerful as bromide, and is preferred by many workers. It acts gently and allows the development of the image with strong shadows and excellent gradation in the half tones. When used, begin with the old solution alone, and gradually add the new to it.

Bromide has its disadvantages when too much is used. It reduces the sensitiveness of the paper, so that the gradation of the half tones is weakened; it alters the colour, imparting a greenish bare tone to the blacks, and while repressing those portions that have received little exposure, it allows the alkali to obliterate the details in the shadows.

Ferrous oxalate has up to the present time held the premier position as a developer for bromide prints, both for enlargements and contact work, being more generally used than any other. The very pleasing range of grey and

black tones which it offers when used with care, and the fact that its pecularities have been fairly grasped by long usage, will account for this popularity.

To secure a good reliable colour with ferrous oxalate, the solutions must be made up accurately and every precaution should be taken to preserve them from undergoing a change. It is better to avoid the use of so-called saturated solutions unless they can be dealt with in a thorough manner. Definite strengths are more trustworthy. Thus, to 50 ounces of warm water add 16 ounces of oxalate of potash. Give it a good shaking up and then make it distinctly acid with sulphuric or citric acid, whichever is preferred. If too much acid is introduced a precipitate will be caused when the developer is mixed. This solution will keep indefinitely.

When making up the iron solution see that the crystals are clear of decomposition, which exhibits itself as a rusty-looking adherent powder. Iron crystals rapidly decay when exposed to a damp atmosphere. To the hot water add the acid. Then add the sulphate of iron crystals and dissolve by agitation. Both solutions should be filtered or allowed to stand until clear before they are used.

Fresh made solution should be used for each print, although the development may be started with old developer. Where the same solution is used for several prints, one after another, the gradation of the half tones is imperfectly rendered, and the general tone becomes indifferent.

The proportions in general use are 1 ounce of iron added to from 4 to 6 ounces of oxalate of potash. The quantities should be varied to suit the character of the enlargement, the length of exposure, and the quality of the negative, bearing in mind the ultimate effect that is wanted.

A more intense black will be obtained by increasing the proportion of iron and shortening the exposure. The contrasts in a flat negative may be improved by this method.

Reversing the foregoing procedure will result in softer tones, such as may be desired for interiors. Some workers prefer to add water to a normal developer to attain similar ends, but it slows the development and gives a brown tone.

Some of the weaknesses of ferrous oxalate may now be dealt with, so that the annoyances they entail may be guarded against. Perhaps the worst of these is the liability of the sulphate of iron solution to deteriorate and change its colour. It gradually oxydizes from contact with the atmosphere. If, when the stock of solution is made, it is poured into a narrow-necked bottle, and filled to the cork, this failing may, to some extent, be overcome. Even after it has altered from green to a reddish brown it will continue to operate, but the colour of the image becomes objectionable. In such a case the simple plan of throwing it away and making a fresh solution is the best. In districts where the water is hard or contains lime, the washing after development is often accompanied by a precipitation of insoluble oxalate of lime on the surface of the paper.

It is more susceptible to the influence of perspiration from the hands than any of the other developers.

The staining effect of pyro, hydroquinone, and hypo coming in contact with the ferrous oxalate solution, even to an apparently trifling extent, is very considerable. The most scrupulous care is needed to avoid the substances named, if clean prints are to be secured.

Unless special care is taken in handling the paper, and in preventing contamination from unclean vessels, stains and irregular markings will disfigure the print.

Then, there is the danger of producing a deposit when additional accelerator needs to be introduced into the already mixed developer, to say nothing of the necessity of being very careful as to whether No. 1 is added to No. 2, or No. 2 to No. 1 when the developer is first made up.

These are all trifling matters to old practitioners and those who may be using ferrous oxalate almost all the year round, but to those who only occasionally use it, or are just commencing, they are difficulties, and as such require to be foreseen.

The addition of bromide tends to impart a greenish tone to the shadows.

Hydroquinone is often recommended as a developer. In my hands the blacks are not satisfactory, and the solution is inclined to induce stains. It produces a brown-black

tone with nearly all the alkalies, and with the powerful hydrates of soda or potash it has the tendency to impart a rusty appearance to the shadows. Used with the hydrate of soda, chemical fog is likely to appear.

When the development is prolonged by dilution, or by excess of bromide, the shadows assume a greenish tone.

A very warm tone, inclining to a warm sepia, may be obtained by mixing the developer, and then allowing it to stand in the measure, exposed to the air, for a few hours before it is used, but the gradations are imperfectly rendered. An acid clearing bath must be employed.

The negative to be used in conjunction with this developer should be free from strong contrasts, otherwise the detail in the shadows is likely to be overcast and obliterated before the high lights have had time to reveal their correct gradations, the result being a hard print. With an evenly-graded negative that has received a full exposure, and reducing the quantity of bromide and increasing the water, very pleasing pictures may be made.

Eikonogen is almost a perfect developing agent for bromide enlargements. It possesses special advantages over any of the other developers, and is likely to supersede them when the facilities it offers are better known. Some of its advantages and characteristics are as follow:—

It is more powerful than ferrous oxalate, and from one-third to one half less exposure is required.

Almost any degree of tone from a pure engraving black to a pearly grey may be obtained at will. The solutions may be concentrated or diluted to suit the character of the subject, and almost any effect that the negative is capable of can be produced.

Compared with hydroquinone and ferrous oxalate, the tone of the image is less subject to alteration when bromide is added, or if the development is prolonged.

The deposit is unusually fine, so that very little of the detail is lost, and the half tones are well rendered.

There is a remarkable absence of stains on the paper.

No special clearing solution other than water is required, although a little acid may be introduced if preferred.

Any portion of the image that is fully developed can be stopped by a camel-hair brush dipped in water, while the backward parts of the picture can be allowed to continue. The water will not degrade the high lights if followed by an acid fixing bath.

In permanency of image it exceeds most of the other developers.

The slightest trace of bromide in the solution is sufficient to secure pure high lights.

Carbonate of potassium alone, or in conjunction with carbonate of soda, may be used as the accelerator. When the latter only is used, the shadows assume a warmer tone.

Hydroxylamine.—The simplest form of this new developer is that sold as Rodinal. It is a highly concentrated one-solution developer, requiring the addition of water, and bromide as a restrainer.

To obtain a black tone, a strong illuminant and a vigorous negative must be used.

It is very powerful, and unless restrained is liable to overwhelm the half tones and stain the margin of the paper.

Water.—The principal office of the water is to act as a solvent and blender of the chemicals forming the developing solution.

When less than the normal quantity is employed, the chemicals in the solution become more concentrated, and therefore produce stronger tones and operate with greater rapidity.

Used in excess, it slows the development. With ferrous oxalate this lengthening of the time results in a warmer tone, without any injury to the gradation of the half tones. An almost similar effect, except that a greenish cast is imparted to the blacks, is produced with hydroquinone. With eikonogen, the addition of more water imparts a grey tone to the image, without loss in the half tones; advantage of which may be taken when a light toned image or softness is desirable.

The Best Formula to Use.— If ferrous oxalate is preferred, the formula issued by the manufacturers of the paper that is being worked is the best to use. The operator

is on safe ground. While the various papers which are offered for sale may have a basis of ingredients in common, the proportions are different in each case, necessitating variation in treatment. The makers, anxious that their productions shall be worked under the most favourable conditions, have striven to secure the formula best suited to their respective papers, and have undertaken extensive experiments with that object in view. It is to their interest that the very best developer that can be suggested should be used. This does not assert that the manufacturers are infallible, nor that they are cognisant of every possible combination of chemicals as soon as it makes its appearance in the photographic world, but simply that their published formula is reliable, and where there has not been much previous experience to fall back upon, the instructions they offer are not only safe to follow but "the best."

With regard to the more recently introduced developers, the position is different. They require quite a different treatment to ferrous oxalate, and their values are only beginning to be known. Time is on their side.

My Special Preference.—To meet the question: "What do you, as a practical worker, recommend as the best developer?" I have taken the unusual course of stating my own preferences. They are based upon accumulated experience, and if they will benefit others there can be no reasonable objection to this course. At the same time I recommend those who have mastered the weaknesses of the iron developer, and are attached to it, to adhere to it as an old and tried friend.

Ferrous oxalate, hydroquinone, eikonogen, and the recently introduced rodinal have all been systematically tested, both for contact printing and enlarging, and the conclusion I have arrived at is, that eikonogen is preferable to the others. The grounds of my decision are :—

1.—The tones are more reliable, and very pure.
2.—The deposit is finer, giving better detail.
3.—There is less liability to stains.
4.—Local development is more under control.
5.—The operation is simplified and more expeditiously performed.

It is not to be expected that all will agree with my conclusions. They are simply offered for the benefit of those who may wish to have them.

Among many good authorities who perceive the possibilities of eikonogen for enlarging purposes is Dr. Just, who affirms: "There is no doubt that eikonogen will take a prominent place, especially for the development of enlargements."

SECTION XIII.

CLEARING.

IMMEDIATELY after development, and prior to fixing, the enlargement must be subjected to a process of clearing.

The softened film of emulsion and its support absorbs some of the developing salt during the development, the effect of which is not alone confined to those portions that have received the exposure, but extends over the entire sheet, back and front, imparting a muddiness to the whole.

The purpose of the clearing bath is two-fold, viz., to arrest the further action of the developer, and to secure the purity of the high-lights and half tones. It also assists the washing by removing at an early stage a large proportion of the loose particles of developer that may have bedded themselves in the emulsion.

Ferrous Oxalate.—Treatment with acidulated water is a necessity with prints that have been developed by ferrous oxalate. If plain water alone is applied directly after development, a precipitation of the iron takes place, and the whole surface becomes degraded in colour.

When an error is made in this respect, the print should be immersed in an alum bath, to be afterwards followed by a dilute oxalic acid bath. It should then be thoroughly washed on both sides with clean water. This treatment will generally remedy the failing, or at least tend to minimize it.

The print should not be allowed to remain too long in the acid bath, as its continued action is liable to injure the delicate details in the high lights.

During the application of the clearing solution the hands should be kept free from contamination by hypo, or irregular stains are likely to exhibit themselves later on about the margin of the sheet.

Various acids may be employed for clearing, the proportions of which are given in the formulæ pages. It is not desirable to use the same bath a second time, as it is more or less impure after use, and the cost is very trifling.

Ferrous oxalate developed prints require special washing before fixing—(see "Washing").

Eikonogen, &c.—A dilute acid bath may be used with the other developers (especially hydroquinone), when, on account of under-exposure, the development has been prolonged, or an unusually strong solution has been employed.

With a rightly timed exposure and a normal developer, water alone is an effectual clearer, but it should be followed by a fixing bath in whieh a proportion of acid sulphite of soda has been placed.

If, after development, the print is immersed, face down, in a bath of water, and left for about ten minutes, it will be found that a considerable amount of the developer has been discharged into the water, imparting a strong colour to it. This should be repeated, or the print laid in running water until all the loose developer is eliminated from the sheet. The enlargement may then be transferred to the fixing bath at once.

Whenever an acid clearing bath bas been used it must be followed by washing, to clear away the acid before treating with hypo.

SECTION XIV.

FIXING.

AFTER removing all traces of the acid bath by washing, the enlargement must now be subjected to fixing.

The purpose of the fixing bath is to dissolve the silver permeating the emulsion, that has not been reduced to a metallic state by the action of the light, and to perfectly fix the image so that it may not be undermined by the chemical influences of daylight, upon exposure to it.

The permanence of the image depends upon the fixation being thoroughly performed, and it is preferable to err on the side of slightly overdoing the work, than to consider it of little moment because evil effects are not seen immediately.

Acid sulphite of soda added to the hypo solution causes it to act with greater rapidity, and improves its efficiency. To some extent it emphasizes the clearing and removes any tendency to yellowing in the emulsion. The quantity to use for ordinary work is about half-an-ounce of acid sulphite of soda to one quart of a saturated solution of hypo. Acid alone should not be used, as it produces a separation of sulphur. Alum should be omitted from the fixing bath, as it slows the working, and is liable to create decomposition.

The proportion of the bath should be one part of a saturated solution of hypo (containing the acid sodium sulphite) to five parts of water. If used too strong, it will weaken the tone of the image.

Although the bath appears to act with rapidity, the print should be allowed to remain in it for a sufficiency of time to ensure perfect fixation. Usually an immersion of from fifteen to twenty minutes will suffice to complete the operation effectually. The effect produced by the fixing bath is that of greater transparency in the high lights when the sheet is examined by transmitted light.

A low temperature, or the previous use of an alum bath to harden the tender surface of the print, exerts a restrictive influence on the fixing, and ought to be allowed for.

When more than one enlargement is fixed at a time, they must not be allowed to adhere together, but should be frequently turned over, and the bottom print brought to the top.

The operation may be performed in feeble yellow light. Although the emulsion, by the previous treatment it has undergone, has lost an amount of its sensitiveness, it is not desirable to subject the print to a strong light for at least the first five minutes. After that time the gas may be fully turned up. Daylight should be excluded until the fixing is complete.

Always use fresh and clean fixing solution to each print. The cost of hypo is trifling, and to save old solution for use a second time with enlargements, is "penny wise and pound foolish."

SECTION XV.

WASHING.

UNLESS the washing is done thoroughly, time will tell tales, and undermine all the beauty that the picture may possess. The high-lights will become discoloured, irregular patches will put in an appearance, and even the shadows will show signs of decay. A little extra trouble taken with this part of the operation will pay well in the end.

Two doses of washing are necessary; the first coming between the clearing and fixing, and the second following the fixing. Especially when ferrous oxalate is used as the developer, is this double system demanded.

The First Washing.—The purpose of this preliminary wash is to get rid of the acid and the loose atoms of developer that may have embedded themselves in the grain of the paper and emulsion. The clearing might be supposed to effect the latter object, and so it does to some extent, but not effectually. It is an instance illustrating the

saying that theory is not to be compared with practice. An excuse to avoid this first washing cannot be found in the fixing bath, for its action will make it all the more difficult for the after washing to eliminate those atoms that have become fixed along with the picture.

Ferrous oxalate enlargements require a full half hour's washing in running water before the print is allowed to enter the hypo. The enlargement should be laid in the dish alternately face up and face down at intervals, thus washing back and front. The dish should be raised a little at the end where the water enters.

The time may be shortened considerably by either of the two following methods: Attach a rubber pipe having a rose at one end, to the tap, and turn on the water at a strong pressure, while the dish is held obliquely so as to allow the water to run off quickly. The force of the water directed on the print, beats out the remains of the developer as the rose is moved over the surface, back and front. The other plan is to gently rub the surface with a tuft of cotton wool or a camel-hair brush occasionally, the water running across the print all the time. We do not recommend this latter method because it is very risky, the surface being extremely tender when wet. It should only be attempted when time is imperative, and then performed with care. If the size is small, squeegeeing may be resorted to, as mentioned in connection with the second washing, but that is better avoided unless a piece of clean mackintosh can be kept specially for the first washing.

The eikonogen and hydroquinone developers require a first washing, but it need not be longer than fifteen minutes in running water, unless acid or alum has been used. These chemicals are not so tenacious as the iron, they clear and wash themselves at the same time. If running water is not convenient, about six changes of water, one every five minutes, accompanied with a finishing flush from the tap will suffice.

The Second Washing.—This takes place after the fixing, and is for the purpose of removing all traces of the hypo from the paper. It is of equal importance with the first washing and is a longer operation.

From one to two hours in running water, with an occasional turn of the sheet to ensure both sides receiving their share, will not be too much. The sheet usually floats on the top of the water, and during the greater proportion of the time its position should be face side downwards, to allow the hypo to fall from the gelatine and be washed away to the outlet of the dish.

The washing may be aided, and consequently shortened by adopting the following method occasionally during the operation: Empty the dish and lay the print on the bottom face up. Now raise the end opposite the outlet and allow the water to fall from the tap on the print at the raised end, and flow off quickly at the lower side. While in this position pass a flat camel-hair brush—such as is used for copying purposes—backwards and forwards over the surface, taking care that the swollen emulsion is in no way abraded. The water swills the hypo off as it is disturbed by the brush. A large clean sponge, quite free from grit (test it first), may take the place of the brush. Rubbing with the finger ends or small plugs of cotton wool is extremely dangerous.

Squeegeeing may be performed with small-sized prints, and will prove very efficacious. One hour's washing with two squeegeeings at intervals will meet the case. A clean sheet of glass rather larger than the enlargement is required. The print is taken out of the water and laid face up on the glass. A sheet of white mackintosh is then laid flat over the picture and a roller squeegee is worked from one end, so that the moisture is pressed out, carrying a good proportion of the hypo along with it. Two prints may be acted upon at the same time by laying one over the other.

To avoid splashing of water as it falls from the tap, fasten a piece of twine so that it will hang from the end of the tap to the dish beneath it, and so act as a guide to the water. Double the twine round the top of the tap and make a knot above the outlet, and another underneath to keep the string in position. A thin stream of water will run down the conductor and keep the water from splashing about the room.

To wash two prints with the same water. If two dishes are at liberty a print can be placed in each dish, face downwards, and the dish fixed as Fig. 11, so that the water from the uppermost dish will fall into the dish below at the

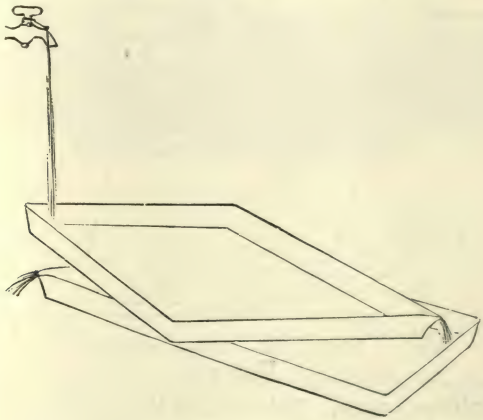


FIG. 11.

corner opposite to the outlet, and from thence into the sink. It is not a wise procedure to place two prints into the same dish as they invariably stick together, and neither one nor the other are thoroughly washed.

A Method of Washing Larger Prints.—When the dimensions of the enlargement are too great to be dealt with in dishes, the following method may be adopted: Obtain a piece of lead-piping, four inches longer than the print to be washed. Drill small holes about half an inch apart in a straight line on one side except the last three inches. This blank end is to be turned up to receive a rubber pipe connecting it with the water tap. The other end is to be plugged up. A flat clean board, rather larger than the print, is placed one edge in the sink and the other against the wall, in a diagonal position. At intervals along the upper side and one inch from the top fix three nails, allowing them to project an

inch. On these nails the lead pipe is laid with the holes turned toward the board, but not directly against it. The pipe may be bent to arrive at the true position, so as to cause the small jets of water to mingle almost as soon as

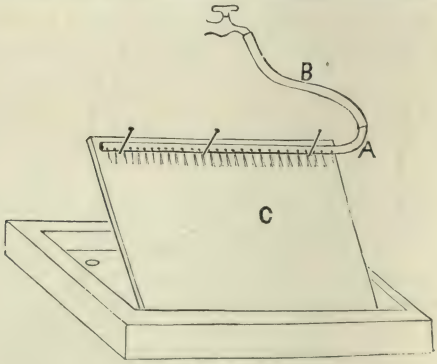


FIG. 12.

they touch the board. When all is in position the print is laid on the sloping board and fastened at the top edge with a pin or two, and the water turned on. The occasional use of a flat camel-hair brush will expedite the washing. After an interval the sheet should be turned, as both sides require to be treated.

Test for Hypo.—Should there be any doubt as to the sufficiency of the washing, test for hypo as follows :—

Potassium Permanganate.....	2 grains.
Potassium Carbonate	20 grains.
Distilled Water.....	1 ounce.

A purple coloured solution is formed. Add two or three drops of this to four ounces of clean water in a glass measure. If a little of the moisture draining from the print is allowed to fall into the pale pink liquid in the glass, and the colour changes to green, it is a sign that the print is not free from hypo, and more washing is required.

SECTION XVI.

DRYING AND MOUNTING.

UPON removal from the washing dish, the enlargement must be allowed to dry by the action of the atmosphere, and without resorting to artificial heat. While the emulsion is soft, dust, and specks of soot adhere to the surface and are difficult to remove; therefore the sheet should not be placed opposite an open window, or in the open air if there is any apprehension of danger from this source.

A simple method of drying, when an enlargement is only occasionally made, is to attach the sheet by one corner, with a pin, to the edge of an overhanging shelf in the room. The moisture drips off from the bottom corner, and the paper is not likely to be stained by coming in contact with the paint or any other injurious substance.

Where a number of sheets require to be dried at the same time, a copper wire line may be stretched across the room, and wooden spring-clips, such as are sometimes used for clothing, fastened at intervals. The enlargements may be hung singly by one corner, or if the clips are threaded along the line and are movable, a sheet may be suspended by the two top corners, between two of the clips.

Another method is to lay the enlargement face up on a clean linen cloth, and gently press a sheet of chemically pure white blotting paper over the surface to absorb the loose moisture. The blotting must be free from fluff and should not be allowed to remain on the print. This procedure will hasten the drying. The sheet may then be laid face up on a clean sheet of blotting or other paper until dry enough to handle.

An ordinary folding clothes-horse forms an excellent drying rack.

Mounting.—Cut-out mounts having a bevelled plain edge (no gilt) suit most enlargements. They may be obtained with white or toned surfaces. When they are preferred, there is no necessity to back the print, but a narrow margin must be left on. The mount-cutter attaches the picture to the mount with glue, and if he understands his work, will stretch the enlargement so that there is an entire absence of cockling.

When the print is to be mounted on a sheet of cardboard, the margins of the picture should be neatly and squarely trimmed with a sharp knife and a straight-edge. Considerable improvement may frequently be made in the balance and effectiveness by trimming away part of an uninteresting margin or an excess of foreground. Do not be afraid of cutting down the print if the picture is improved thereby. What is termed proportional shape is entirely a matter of taste, and should only occupy a secondary position. Too often it becomes an artificial restriction, and is better sinned against than conformed to, if it interferes with the pleasing representation of the subject.

The print to be mounted should be laid face down on a sheet of paper, and receive a coat of paste applied with a brush. The edges must have special attention, and the paste should be evenly distributed. Remove any loose hairs that may have become detached from the brush. The sheet should be held down with one hand until the moisture in the paste causes the paper to become limp. After a short interval a second coat of paste should be applied. The print may then be placed upon the mount and drawn into the exact position it is to occupy. By laying

a sheet of paper over the surface to protect it, the print may then be rubbed down by the hands, and made to adhere to the mount, especially at the edges. Should there be any evidence of enclosed air between the print and the mount, it may be removed by working the lower edges of the hands from the centre of the sheet towards the margin. If too much pressure is used the sheet will be unduly stretched, and cause the mount to warp as it drys.

When a number of prints of the same size are to be mounted, the following arrangement will save time and the trouble of measuring the margins. On one of the mounts, or on a sheet of cardboard of the same size, mark with a lead pencil the outline of the print in correct marginal position. Along two edges of a board, form a raised angle by nailing two ribs of wood. Into this corner the marked mount is placed. When the print has been pasted, it is laid face down on the marked mount, squarely by the pencil marks. All that is now required is to take a fresh mount and lay it face down into the angle, so that it will come in contact with the pasted back of the print. A gentle pressure of the hand causes the two to adhere, and the mount is lifted up with the print in position. A rub-down, over a sheet of paper completes the operation.

The top and the two side margins of the mounts should be equidistant. A little extra space may be allowed at the bottom. The purpose of the latter is to leave room for the title of the subject, but apart from that, the eye has become accustomed to the extra margin usually allowed in engravings and monotone pictures.

Mountant. — Either starch-paste, or a solution of gelatine may be employed as suitable mountants. Whatever the adhesive substance used, it should be colourless, free from acids, and dry with a dead surface. Gums, glues, and patent pastes are not suitable, because they do not possess the foregoing qualifications. Nearly all the patent preparations contain injurious matter which has been added to preserve them from decomposition.

Starch paste meets the requirements and is quickly made. Use Glenfield starch, to be had at most grocers' shops, and all uncertainty as to adhesiveness and purity will be avoided.

To prepare the starch, place two or three teaspoonfuls into a clean jam pot or other vessel. Add a little cold water, only sufficient to just make a thick smooth cream. With the spoon press this by a grinding action, so that all lumps may be reduced to a pulpy state. *Boiling* water is then poured in from the kettle, during which the substance is continually stirred with the spoon. A thick transparent paste will be produced. When cold it should be strained through a piece of muslin or open cloth, to remove the surface that forms as it cools and to cause the paste to work evenly on the paper. It will need to be forced, by pressure of the hands, through the cloth while the ends of the latter are twisted up, and the paste is enclosed like a ball. It is worth while to take a little trouble to prepare, as that secures comfort afterwards.

A good gelatine mountant may be prepared as follows :— Soak 2 ounces of photographic gelatine in 20 ounces cold water in a large jam pot. When the gelatine has become soft, place the jar in a pan of water and put it on the fire. After the gelatine is dissolved, add 10 ounces of methylated spirit in successive small quantities, stirring well between each dose, until the cloudiness—caused by the spirit—disappears. It may then be poured into smaller pots and allowed to set. When wanted for use, simply place the pot in a pan of water on the fire, and when the solution is melted, proceed with the mounting.

SECTION XVII.

SPOTTING AND RETOUCHING.

SLIGHT imperfections in enlargements may be more or less remedied by the majority of operators, though it is obvious that an amount of skill and practice is necessary to produce results equal to those of a professional retoucher. Nevertheless, many defects may be corrected by a few touches in the right places, if care is exercised and the work is not overdone.

Black specks may be removed with the point of a keen erasing or pen-knife. It must be lightly applied, just grazing the surface and disturbing nothing beyond the dark speck itself. If a defective white mark is left, the place should be gently touched with a B or HB pencil, or crayon, until the surrounding tone is matched.

Light coloured specks that have been produced by an opaque mark in the negative may also be worked up by a pencil in preference to a crayon, or water colour. The former offers a firmer point and is easily cleaned out with a piece of rubber if not satisfactorily done.

For working up in crayons, those parts to be operated on will require to be rubbed over with pumice powder to give a tooth to the surface.

Specially prepared crayons are sold for this purpose, embracing various degrees of hardness and of different shades. Common crayons are rarely suitable, being of too brown a colour for the generality of enlargements. Conté crayons, Nos. 1 and 2, will sometimes be found serviceable. The tone of the image must be matched or a patchy effect will be produced. Work the crayon carefully, putting in a touch here and there, and strengthening weak lines with decision.

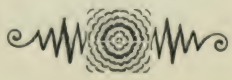
When a broad surface requires to be worked over and toned, a stump, or what amounts to the same thing and forms a good substitute, a piece of wash leather doubled over the finger end, must be used. Powdered charcoal or crayon will supply the colour. The stump, charged with the colour, is rubbed over those parts calling for a stronger tone. High lights may be taken out with a piece of soft bread crumb that has been rolled to a point between the finger and thumb, or the application of a pointed piece of india-rubber may effect the same end.

If water colours are preferred, they must be mixed with ox-gall, to be obtained from the artists' colourmen, or difficulty will be experienced in flowing the colour evenly on the surface of the print. Ivory black, indian ink and neutral tint, separately or blended to match the tone required, will be found useful.

High lights may be introduced by chinese white, by itself, or, if too white, it may be toned down by the addition of a darker colour.

Cross hatching, which is often used as a background for vignettes, may be performed either in water colours or by crayons. It requires considerable practice to introduce it effectively. A succession of slightly curved diagonal strokes are crossed obliquely (not at right angles) by a similar series of lines, affording a sketchy tone with softened edges. If the picture has not a toned background already, one may be washed in—it should not be heavy—and the cross hatching can be worked over it. When water colours are used the greatest difficulty is to secure a regularity of line, and to avoid forming little blots of colour at the termination of the stroke. This trouble may be largely overcome by not using the colour in too moist a state, and by pressing firmly on the brush at the beginning of the stroke.

When oil paints are used, there is no necessity to use any size as a preliminary groundwork, the emulsion on the surface of the paper being sufficient in itself.



SECTION XVIII.

TONING.

THE question as to whether a picture is improved by toning is one that appeals largely to art taste. That which may be pleasing to one individual is obnoxious to another. All have their preferences based upon early training, association, or prejudice, and when once these are fixed they are not easily moved. In the face of this position it becomes a difficulty to say what class of subjects is better translated into warm tones and which should be rendered in cold tones. Artistic representation may be based on truth, but it is also influenced by fashion, and each worker, exercising his own judgment must decide the question for himself; only a few indications can be made here.

Without a doubt some pictures lend themselves admirably to a warm monotone; they become more realistic and approach nearer to a representation of nature than they would if depicted in cold tones. For instance, a setting sun effect is more truthfully rendered as a warm sepia or even a red than it would be if presented as a cold grey or a blue-black. Whenever sunshine is characteristic of the scene, and rays of sunlight are represented throwing oblique shadows over the gables of buildings, or spreading themselves across the footpath as they come through the branches of trees, indicating warmth and colour, there can be no error in toning. Occasionally nature is stern and heavy, but she is rarely in that mood when the photographer attempts to depict her features. The representing of figures in Bartilozzi red is simply a matter of fashion, and if it pleases the producer of the picture there is little room for others to complain.

Uranium Toning.—The operation of toning bromide enlargements by the uranium process is comparatively simple and gives more satisfactory results than any other. It is unimportant which of the developers has been employed in producing the basis of the image if the quality is suitable. Ferrous oxalate, eikonogen, or hydroquinone prints are all susceptible of toning with equal facility.

Success depends upon attention to the following points:—

1. The print should not be strongly developed in the shadows. The process being one of intensification the details in the shadows must be clear or they are liable to be overwhelmed. A more regular gradation will be secured if the ferrous oxalate—supposing that has been the developer—has been rather weak in iron, which is equal to saying that if the image is grey and free from strong contrasts, it is in a suitable condition. Frequently pictures that are disappointingly weak and flat through improper development or fixing undergo a considerable improvement after toning, but to obtain the best results it is important to obtain a technically perfect print. The tone and general effectiveness are controlled by the regular gradations exhibited in the original image, and if it is weak in this respect the toning cannot supply the deficiency.

2. Nothing less than thorough fixing will serve. When this has not already been performed the print had better be subjected to another bath, indeed a system of dual fixing will always prove beneficial when toning is intended. After the first fixing, place the print without washing into an acid fixing bath made up as follows: Hypo 2 ounces, acid sulphite of soda 1 ounce, water 20 ounces. This bath will dissolve all the free silver from the film and effectually clear the image.

3. The print must be efficiently washed. After half an hour in running water or a number of changes of water during the same time, use the squeegee to eliminate the hypo. The print should be laid face down on a sheet of glass and a piece of mackintosh laid over all. The application of the squeegee from one end will force out the liquid carrying the hypo with it. Another half-hour's washing and an occasional squeegeeing will accomplish the end

sought. Don't spare the water nor begrudge a little extra trouble; the hypo must be totally eliminated.

4. Allow the print to dry before using the toning bath. This assists the after process very materially.

5. Perfectly clean vessels, uncontaminated hands, and pure chemical manipulation are indispensible.

The toning solution is prepared as follows:—

No. 1.

Ferricyanide of Potash	20 grains.
Acetic Acid	240 grains.
Water	10 ounces.

No. 2.

Uranium Nitrate	20 grains.
Acetic Acid.....	240 grains.
Water	10 ounces.

Mix equal parts of Nos. 1 and 2 together just before using.

About four ounces will be sufficient for a 15 × 12 picture. First soak the print in clean cold water for ten minutes, then, while it is wet, lay it face up in the dish so that the back will adhere by the moisture. Take off the surplus water from the surface with a sponge, or a plug of cotton wool, and do not allow any water to remain in the dish. Pour the solution in, and allow it to flow from side to side so that every part will receive a share. By applying the liquid with a flat camel-hair brush, and working backwards and forwards over the surface, air bubbles will be avoided and the toning will proceed uniformly.

After the colour has changed to a satisfactory tone, pour off the solution, and run clean water into the dish to stop the toning. Now pour the water off, and dipping the camel-hair brush or plug of cotton wool in the clean water, work over the surface and back of the print to remove any yellow stains and the surplus ferricyanide solution. When this is complete, wash the print in several changes of water, and it is ready for drying. It is not advisable to overdo the final washing.

If the colour is not satisfactory it may be returned to its original state by soaking for a few minutes in a carbonate of soda solution, and after a thorough washing, the process may be commenced again.

The toned image goes back to some extent in the washing, and an allowance should be made on that account.

The colour proceeds from the original through a brown to a warm sepia, and eventually to a red.

A very good suggestion by which very little of the toning solution is needed, and the use of large dishes altogether dispensed with, has been made by Mr. S. Herbert Fry. He says:—"Have a piece of glass larger than the print to be operated upon. Soak the print in clean cold water thoroughly. Lay it down wet, and face upwards, upon the sheet of glass. Take a large handful of cotton wool, soak it like a sponge in clean cold water, and rub it over the surface of the bromide print so as to remove the surplus liquid, and squeegee the print down flat upon the glass. Have some toning solution at hand in a saucer, wring out the water from cotton wool, and soak it in the toning solution. Place a couple of fingers of the left hand upon the same side of the print, and with the cotton wool saturated with toning in the right hand, boldly and freely work it all over the face of the print, until the desired tone is there. Keep the cotton wool well saturated and moving freely, and there will not be any staining. When sufficiently toned remove any surplus ferricyanide solution with the wool, and proceed to wash the print with clean cold water with a fresh piece of cotton wool, until the yellow stain is removed from the fibre of the paper. Sometimes this won't all come out, especially if a very rough-surfaced and absorbent paper be employed; but many prefer a tinted to a white paper effect. There is nothing new in this method, but it is, nevertheless, the best way of using the uranium toner, and to avoid staining and other irregularities. Less solution is required, and no large bath."

Black or Blue Tones.—

Sulphocyanide of Ammonia	30 grains.
Chloride of Gold	1 grain.
Water	4 ounces.

Half a minute in this bath will give the print a rich black tone; a longer time will turn the print blue, which answers very well for moonlight effects.

SECTION XIX.

STAINS AND IMPERFECTIONS.

STAINS and discolourings usually arise from using unclean vessels, the careless use of chemicals, or from a lack of thoroughness in performing the various operations. These are all controllable, and need not occur.

Yellow tone in the paper. This fault usually exhibits itself some considerable time after development, when, perhaps, the enlargement has been framed and hung a few months. It becomes more pronounced with age. The effect is often associated with the iron developer and may have been produced by either of the following: (1) Imperfect clearing. When the clearing solution has been used, only the face of the sheet has received attention, and the back having remained in contact with the dish has been neglected. The sheet should be lifted up to allow the clearing solution to act on both sides of the paper. It may be remedied by treatment with oxalic acid solution or a very dilute solution of sulphuric acid. (2) Insufficient washing between clearing and fixing. Particles of both acid and iron have remained imbedded in the film and its support, and they have begun to assert their presence. The fixing has only tended to retain them and make the after washing inoperative so far as they are concerned. It is almost impossible to remove without injury to the image. Half an hour's washing is requisite for the iron, and a quarter of an hour for the other developers. (3) The final washing has not been thorough. At least one hour in running water with an application of the squeegee should have been given. The remedy in the two latter cases is to perform the work more efficiently in the future.

Green and grey stains are caused by the use of a strong accelerator which has not been sufficiently restrained by bromide. They usually appear when the development has be prolonged in consequence of too short an exposure. They are chemical stains that are practically unalterable. The future remedy is give a longer exposure.

Brown stains are produced by traces of hypo, pyro, or hydroquinone in the vessels, or on the finger ends. The ferrous oxalate developer demands perfect cleanliness. If the dish has been previously used for pyro development or for fixing, it should be treated with hot water and washing soda applied inside and out with a flannel and plenty of elbow grease. The hypo bottle should not be touched until the print is ready for fixing. The stains are difficult to remove from the paper without injuring the image.

Yellow patches are generally caused by an insufficient use of the clearing bath. The prints should remain fifteen minutes in the bath and receive at least two changes of clearing solution.

Blisters may be caused by the use of warm water or by employing a strong accelerator such as caustic soda or potash. The remedy is to place the print in a bath of common salt and water immediately after fixing and without previous washing.

Mealy Prints are the result of using an alkaline oxalate, or a lack of iron in the developer.

Want of Vigour is produced by over exposure, or inert chemicals.

Stain Remover. — The generality of stains may be removed by treating the print with a dilute solution of potassium cyanide in which a few drops of iodine have been introduced. About one dram of the cyanide to eight ounces of water will usually be found sufficient, but it may be reduced or increased according to the stains which have to be removed. First soak the print for five or ten minutes in water, then place it, face up, on the bottom of a developing dish turned upside down. Dip a camel hair mop in the solution and go over the stains with it. They will disappear like exorcised ghosts. Immediately wash the prints thoroughly in clean water.

SECTION XX.

ENLARGING WITHOUT CONDENSERS.

ENLARGEMENTS may be made by artificial light and without the aid of condensing lenses. The arrangements involved in the operation are an adaptation or imitation of those presented in enlarging by daylight, when using a light-diffusing screen before the negative. The room being in darkness, a powerful light is produced by burning magnesium, all the rays except those passing through the light diffuser, negative, and lens, being excluded from the sheet of sensitive bromide paper.

The advantages this system has over daylight enlarging are that the work can be performed in the evening, and in any room—whatever its aspect—that is commodious enough. The operations may also be conducted in the daytime if all daylight can be excluded from the room.

Two different methods may be employed; the light may be encased in a box while the sheet of bromide paper is placed on an easel in the open room, or the bromide sheet may be enclosed while the magnesium ribbon is burned in the open room. Either method will give satisfactory results if performed with discretion. Success depends in a great measure on the judgment displayed in giving the correct exposure demanded by the negative; the exposure not being calculated by the time occupied, but by the number of inches of magnesium ribbon burned in front of the screen.

The action of the ground glass screen placed before the negative to diffuse the light, may be compared to that of a multitude of minute plano-convex and plano-concave lenses fixed in interminable rows over a plane and at all angles. The comparison is not strictly correct, for in reality the roughened surface consists of a series of irregular prisms rather than lenses. They receive the divergent rays from the point of illumination, and project them in a diffused mass, in all directions, over the negative. That this is the case is demonstrated by the fact that either side of the ground glass may be turned towards the negative and the same effect will be produced. It is better, in practice, to turn the rough side of the glass away from the light, so that if the latter should come in contact with the surface of the glass the mark that is made may be easily cleaned off.

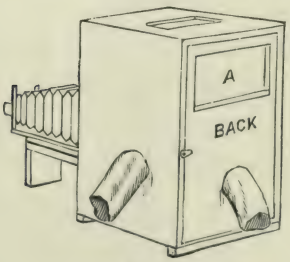


FIG. 13

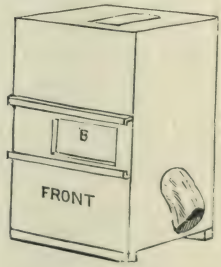


FIG. 14

In the method to be described, the illumination is produced in a box while the bromide paper is attached to an easel in the room. I am indebted to Mr. Monkhouse, of York, for the original suggestion. Some of his arrangements have been altered and simplified; for instance, dispensing with the construction of a special camera and carriers for negatives, an ordinary long-bellows camera is substituted, and the negative is placed in the double back belonging to the camera. Either a quarter, half, or whole plate camera may be employed if the bellows will rack out sufficiently and the enlargements are not required to be more than three or four diameters of the negative,

or a whole plate camera may be employed and carriers made to go inside the large double backs for the smaller sized negatives.

A box, about 24 inches high, and 16 inches square, inside measurements, is provided. Underneath, two pieces of wood, one inch square, are fastened to the front and back edges, to raise up the box. The timber of which the box is made need not be more than half an inch in thickness, but must be light-tight.

To obtain ventilation, drill a few holes through the bottom, and make an opening in the top, about 12 inches by 4, the longest way being parallel with the door. To prevent light issuing from this opening a piece of tin or sheet iron $15\frac{1}{2} \times 12$ will be required. Two ribs of 1 inch wood should be attached to the sides at a right angle to the door when closed, and at about 2 inches from the top. On these, the metal plate rests.

One entire side of the box which may be termed the back (see FIG. 13) is made to open as a door, with hinges and turn-button. The edge of the box should be rebated to receive the door so that the light might be effectually enclosed, or a rib of wood may be fastened round the inside of the box to effect the same purpose. Towards the top of the door a 10×8 sheet of ruby or orange glass **A** is inserted to enable the operator to look inside when manipulating the illuminant. Lower down, a circular aperture is made, and a black cloth sleeve is attached, one end being tacked or glued round the edge of the wood. At the other end an elastic band to encircle the wrist, is sewn to the cloth.

In the front side (FIG. 14) opposite the door, an opening **B** is made, an eighth of an inch less each way, than the negative intended to be used. Inside the box, a piece of ground glass is placed over the aperture **B**, close to the wood, and with the rough side turned away from the door. It should be half an inch larger than **B**, each way. A rib of wood, bevelled inwards so as to hold the glass close to the side of the box, may be placed just below the aperture as a support to the screen, with a turn button at the top. An additional sheet of transparent glass may be hung in

front of the ground glass as a protection from the burning magnesium ribbon. Outside the box, a rib of wood should be attached to the top and another to the bottom of B as shown in FIG. 14. They must be rebated to receive one side of the dark slide which slips in or out at either end. The other side of the dark slide is to remain in its usual position in the camera. When the two ribs have been attached, a stand on which the camera may rest firmly should be made, see FIG. 13. It must be built accurately, so far as height is concerned, so as to avoid straining the double dark slide when it is inserted between the camera and the ribs on the box.

On the left hand side another circular aperture and sleeve is required similar to the one in the back.

For focussing purposes, either a good duplex lamp will be needed, or a small standard gaslight. The latter is the best, if a gas jet is near. The attachment can be made by means of rubber piping passing into the box through one of the holes in the bottom. Whichever of these is adopted the flame must come opposite the negative and be movable. It will be found easier to focus a particular part of the negative without the ground glass screen, but the size of the image can be better seen when the screen is in its place.

The articles for use in the box, in addition to the focussing light, are a candle and candlestick, a pair of pliers, and the pieces of magnesium ribbon cut to short lengths of 5 or 6 inches.

An easel will be required to which the bromide paper is to be attached. The form or size is a matter of choice, and need not be dealt with here. A drawing board will do, or the back of an ordinary door, against which a table is placed, may be pressed into service at a time of emergency, but the face of it must be parallel with the lens and negative.

To make the enlargement proceed as follows :—Place the box and camera on a table or bench, 4 or 5 feet long, with the easel opposite the lens. Insert the negative, film towards the lens and upside down. Place a sheet of white paper, the size of the enlargement required, on the easel. Put the candle, magnesium ribbon, pliers, and focussing

light into the box. Light a Ruby lamp, and exclude all light from the room except that coming from the lamp. By the focussing light, focus the image on the sheet, making such adjustment of lens, easel, or box, as may be necessary to obtain the correct size and perfect sharpness of the image. When this is secured, remove the focussing light, and light the candle. By the aid of the ruby light, replace the sheet of plain paper by a sheet of sensitive paper, in the exact position. The burning candle inside the box will do no harm if placed to one side, so that it will not be opposite the screen. Insert the right hand in the sleeve in the door, the left hand in the sleeve at the side, and looking through the ruby window take up the pieces of ribbon in the left hand, and the pliers in the right. Place one end of a piece of ribbon in the pliers and light the other end at the candle. Move the burning ribbon before the screen, from side to side, top to bottom, and sometimes bottom to top. Repeat this operation with each piece of ribbon, varying the movements as much as possible, and giving extra illumination opposite any part of the negative that may be over dense, or requires it. Care must be taken that the apparatus is not shaken in the slightest when the ribbon is burning. The exposure being now complete, withdraw the hands, take down the the bromide sheet from the easel, and, protecting it carefully from white light, it is ready for development.

The number of pieces of magnesium ribbon to be used will vary, according to the density and colour of the negative, the size of the enlargement, and the stop used in the lens, but ordinarily from five to eight pieces are sufficient. The right quantity will soon be found by a little practice, and should be noted down.

Use a rapid rectilnear lens of medium length of focus, and the largest stop that will give sharpness at the corners of the image.

The enlarging apparatus, FIG. 15, possesses many features in common with that previously described. It is a combination of box and camera, and the illumination of the negative is produced by burning magnesium ribbon in front of a ground glass screen. The essential difference consists in a reversal of the positions of the bromide paper and the

illuminant, the former being enclosed in a box, while the latter is manipulated outside the apparatus in the open room. One of the advantages possessed by the arrangement now to be described is that the enlarged image can be focussed sharply by means of a piece of ground glass and a focussing lens, prior to inserting the sheet of bromide paper. A sheet of clear glass is let into the rebated end of the box. Against this glass the face of the bromide paper is intended to be placed. A close fitting wood-back is super-imposed on the paper, and fastened down, so that all light is excluded from entering at that end. It will be readily seen that if a piece of ground glass is laid with the roughened side upon the transparent glass before introducing the paper, that the image may be examined by the aid of a focussing or magnifying glass, and that perfect sharpness may be secured.

Another advantage over the first method is, that by burning the magnesium wire outside the apparatus, liability to create vibration during exposure is reduced. The arms are not introduced into the box, and there is no necessity to touch it while the exposure is being made.

A weakness in the arrangement now suggested is the fact that the size of enlargement is limited to the measurement of the enlarging chamber.

The diagram may now be dealt with :—

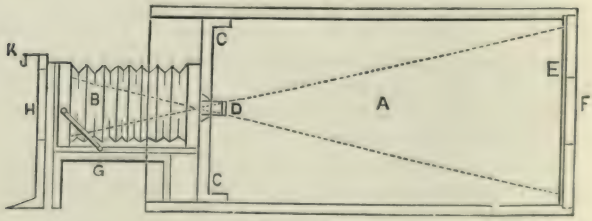


FIG. 15.

A.—The enlarging box, open at one end to receive camera **B**, and containing a sheet of glass and a removable backboard at the other end.

B.—Ordinary camera carrying the negative and lens. The negative may take the place of the ground

glass, or be inserted in a double dark slide having both shutters drawn out.

C C.—A sliding division—close fitting—with bevelled circular aperture in centre to admit the rim of lens attached to **B**. If a pair of thin sliding doors are made to work in projecting grooves, attached to **C**, with a circular opening in the middle to clip the neck of the lens after the latter has been inserted through the aperture, all danger of light entering the enlarging chamber will be avoided.

E.—Sheet of perfectly clear glass, let into rebate in end of **A**. It can be imbedded in putty or used loose.

F.—Three-fold backboard, fitting close in rebate and flush with end of **A**. It should be covered with coarse cloth or sheet-rubber on the inside after the manner of a printing frame back. The three sections are hinged together, and held in position by turn buttons fastened to the edge of the box. (See details of easel, Fig. 6, having same arrangement).

G.—Stand for Camera. The leg standing inside the box to be shorter than the outside leg.

H.—Frame carrying ground glass, and to which the ends of wire **K** is attached.

K.—A projecting wire with loose hooks for hanging lengths of magnesium ribbon on.

The box should be made from wood that is thoroughly dry, or the shrinkage may warp it, and interfere with the easy action of the sliding piece **C**. Should any difficulty arise from this cause, a coating of blacklead may prove beneficial as a lubricator.

For 15 × 12 enlargements and under, using quarter-plate negatives, and a lens of six inch focal length, the inside measurement of the box or enlarging chamber must be at least thirty inches long, twelve inches in height, and fifteen inches in width. A lens of longer focus would need a longer box, but a reference to the table of enlargements on page 12 will supply the dimensions that may be necessary for any of the usual sizes.

The frame **H**, carrying the ground glass and wire may be a simple contrivance (see Fig. 16) with feet to keep it

upright, and top and bottom ribs to hold the glass. The end of the wire hooks on which the magnesium wire is hung should be level with the top of the negative, and should hang about one inch from the ground glass. When in use, the ground glass should be placed half-an-inch from the negative. The number of pieces of magnesium to be burned will depend on the density and colour of the negative, but as the hooks are adjustable, more or less lengths of the magnesium may be suspended from them. If placed from one to one and a half inches apart, the illumination will suit the generality of negatives. In cutting the pieces of magnesium wire, make them of such a length that, when hanging, the lower end will reach half-an-inch below the bottom edge of the negative, remembering that the flame ascends, and that allowance must be made for it.

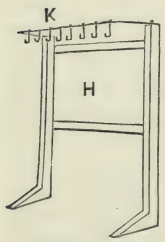


FIG. 16.

Use a rapid rectilinear lens, with the largest stop that will give sharpness at the corners.

A cloth may be thrown over the end of the box adjoining the camera, during exposure, to intercept any stray rays of light from entering the enlarging chamber.

When all is ready for the exposure, light the pieces of magnesium wire at their lower ends, one after the other. The fact that they are not all burned at the same moment makes no difference to the result.

A duplex lamp placed in front of the screen may be used for focussing purposes, or, if the box rests on a table near a gas jet, a length of india-rubber piping with a small standard light at one end will be found handy.

SECTION XXI.

DISHES AND THEIR CONSTRUCTION.

FOR small enlargements such as whole plate or 10 x 8 sizes porclain dishes are not very costly, and will be found convenient. When larger baths are required the expense involved in purchasing porcelain becomes a serious item, and substitutes may be adopted to reduce the cost. Some methods of producing home-made dishes have been given to the photographic journals from time to time, but many of them are not satisfactory. They are often of a "messy" nature, bad to clean, or are such rickety concerns that they annoy the worker and spoil more paper than would purchase trustworthy utensils. The following forms may be made cheaply and will prove reliable if constructed and used with judgment.

Wood and Glass.—Obtain some strips of wood, half inch by two inches. Hard wood is the best, but rather difficult to work. With a suitable plane, run a groove along one side, about a quarter of an inch from the margin, to receive the edge of a sheet of glass, as shown in the illustration. A neighbouring joiner will do this for a mere trifle. Cut up these strips to the correct lengths to form four sides of the dishes intended, allowing for a joint at the corners, and so that the dishes will be half an inch larger each way—inside measurement—than the sheets of paper they are to receive. After preparing, and before fastening together, fill in the grooves with putty. A sheet of glass cut to fit should next be inserted, a thin coating of putty laid on each joint, and and the sides and ends pressed steadily home. The corners

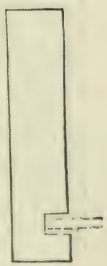


FIG. 17.

should now be fastened by sprigs or wooden pegs, and the putty neatly trimmed with a knife. In a few days the dishes will be ready for use, and if the work has been performed carefully there will be no leakages. Should there be any difficulty about making the joints, square ends may be adopted, one side overlapping the other, and in such case the ends may be fastened with thin screws.

Millboard Bottoms previously waterproofed by paraffin wax, or several coats of bath enamel, have been suggested to overcome the risk of breakage which glass entails. The bath enamel paint is the best to use, and it should be applied on both sides because the millboard swells and "cockles" if water gets on any part of it. The weakness of this style of dish is that there is a tendency to bag in the centre after using a few times, especially if any weight of water is placed in it.

Wood Bottoms.—Thin wood, such as is used for backing pictures, is nailed on the bottom of a square frame of wood. A lining of mackintosh (white is best for cleaning) is laid inside and turned up at the edges. The corners are doubled over and held in position by a tack driven through the cloth into the wood. The mackintosh can be attached to the wood by glue or cement. If folded over the top edge, water is prevented from getting underneath it. This makes a light dish and is very serviceable. By using half-inch wood—tongued and grooved—there is no necessity for a mackintosh lining, but all the joints must be filled up with putty and several coats of bath enamel paint applied all over the inside as security against leakage.

Old Picture Frames.—Another method is to utilize old picture frames of the right size, making the joints and glass secure with putty and building up the sides with additional strips of wood, and in that way obtain the requisite depth. Extra care must be used with this kind of dish, because of its structural weakness.

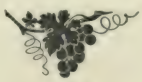
Cardboard.—For occasional use or to contain the fixing solution, a cardboard dish may be found serviceable. In appearance it will resemble the lid of a draper's box, and sometimes it is made from one. It is not a suitable vessel to use when developing, because it cannot be moved with safety.

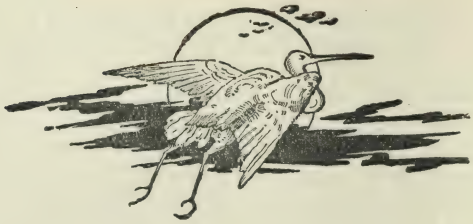
The tilting to one side so as to allow the solution to run off some part of the picture already printed sufficiently, would be attended with risk, and there is always danger of a collapse when much water is poured into it, or it requires emptying. If one is made, the corners should be bound with cloth attached by marine glue, and the inside should receive two or three coats of bath enamel.

Willesden Paper will make a temporary bath by bending the four edges up and clamping the corners with strong paper clips. As they are liable to double up when lifted with any weight in them, they should be placed on a flat board as a support and moved about by means of it.

Dish formed from the exposed sheet. Upon an emergency the exposed sheet of bromide may be made to serve as a dish for itself. Turn up a half inch of the margin all round the sheet, folding it so as to make a distinct crease. Then fasten the pinched-up corners with small spring clips. The sheet must be laid on a flat board, and care used with the solution.

To Repair Cardboard Dishes.—Obtain some gutta-percha solution or marine glue, and lay a strip of it on the broken ends of the joint when they have been drawn together. By the aid of a hot knife or piece of iron melt the composition, causing it to run into the joint and get well among the broken ends or layers of the cardboard. Press the joint together firmly while the solution is still hot, and hold it until it sets. Ordinary photographic chemicals have not any injurious effect on either of the above cements, and unless hot water is used in the dish, or it is held too near the fire, there is little danger of any leakage when in use. It is desirable to open the layers of cardboard with a penknife, if they are not already in that condition, to ensure a complete union of the materials.





SECTION XXII.

ENLARGED NEGATIVES.

SOMETIMES it is desirable to make enlarged negatives from small ones, so that prints may be made direct upon other papers than bromide. This may be done successfully if care is used in the various manipulations. A sharp quarter-plate negative may be enlarged up to whole-plate with so little loss of definition that it will be almost impossible to tell whether the latter is an enlargement or not. In the first place the original negative must be thoroughly sharp, even to the corners, because it is in the corners that an enlargement is usually found wanting. A half-plate lens should be used in a quarter-plate camera to secure this fine definition. For the generality of landscapes this narrower angle will give the best results, but a good quarter-plate rapid rectilinear lens may be used.

The plate for the small negative should be one that possesses a finely-grained emulsion. A wide difference in this respect will be found in the various brands that are offered, and a low-power microscope will prove serviceable in determining which is the most useful for the purpose.

Having focussed accurately, give a full exposure and develop with care so as to produce all the detail, but not too much density. This also applies to the transparency.

In a valuable paper on making enlarged negatives, contributed to "Photography" by Captain Abney, the following comment on the original negative is made. He says: "In order to get first-class results the original negative must be

of such a thin character that it will only yield a flat print, even with the most careful selection of suitable paper, and when it becomes of such a graduated density that it yields a good print it ceases to have the best quality for enlargement. This is due to the fact that a photographic plate does not yield the same gradation that it should do if were perfect. Details in the high lights will be wanting, or details in the shadows."

From the negative obtained an enlarged transparency is to be made in a copying camera or by an enlarging lantern. Whichever of these are employed, it is important that the plate which is to receive the enlarged picture should be protected from all light except that which comes through the negative and lens. Another condition that must be attended to is to observe that the negative, the lens, and the focussing screen or enlargement are all parallel with each other. The same lens which was employed when the original negative was taken may be used, although a rapid rectilinear of about whole-plate size will prove to be the more suitable, because the extra focal length will allow the enlarged image to be imprinted more perfectly sharp at the corners.

The time of exposure will depend upon the character of the negative, the rapidity of the plate used, the illuminant, and the stop inserted in the lens. As each of these will vary with each individual who adopts this method no fixed time can be given. Tests may be made in the first instance upon small plates to save the cost of large sizes, and the data thus obtained can be kept for future reference and operations. A few trials with a record of the exposure and the developer which is found to meet the requirements of the worker, will supply an experience that may be called upon at any time when required.

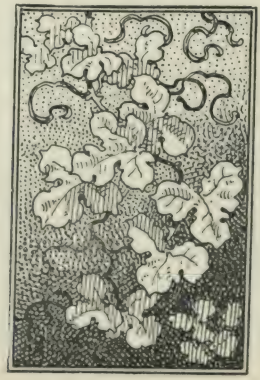
From the enlarged transparency a negative is produced by contact, just as a bromide or alpha print is made, except that an ordinary glass negative or film is used in place of the paper, and a negative is obtained instead of a positive.

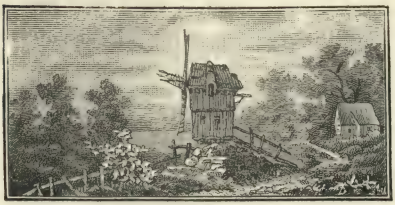
An exposure of from ten to fifteen seconds at three feet from an ordinary gas-jet will be found about right. The shortest exposure that will produce a full developed negative

is best. Add a little sulphite of soda to the developer if pyro and ammonia are used, to obtain density and carry the development far enough to give a vigorous image, but not so far as to cloud the shadows too much.

If the operations have been worked out with care and judgment an enlarged negative may be produced which will be very little, if any, inferior to one that has been made direct in a large camera.

An alternative method, that of making a small transparency by contact from the original negative and then obtaining an enlarged negative from it is sometimes adopted, but the general opinion of experienced workers is that it does not give such good results as may be obtained by the first mentioned plan. If the second method is preferred, the granularity of the negative may be overcome by inserting a thin sheet of transparent gelatine between the negative and the positive during exposure, to diffuse the grain in the original. Expose to a gas-flame, moving printing frame in a small circle, and then develop till all the details are fully out. After fixing and washing a good positive will be obtained, from which an enlarged negative free from granular marking can be produced by a bromide enlarging camera, either by daylight or artificial light. If the enlarged negative is made by daylight insert a piece of opal glass between the positive and the light.





SECTION XXIII.

HOW TO TREAT FAULTY NEGATIVES.

ONLY those negatives that are free from blemishes ought to be subjected to the process of enlargement, because the faults are also enlarged and become more prominent than they were in the negative. Even the retouching marks on a portrait, unless it has been very finely worked up, become an eyesore on an enlargement, although the marks were comparatively insignificant on the original. There are cases where a second exposure for the purpose of securing a perfect negative cannot be made, and at the same time an enlargement is urgently required. Under such circumstances there is no other resourse but that of trying to mitigate the objectional failings by improving the negative so far as is practicable, and then retouching the enlargement afterwards. The hints now given may prove serviceable in such cases.

Scratches and abrasions on the film may be divided into two classes, viz., narrow lines or scratches probably caused by friction when the plate is dry, and those that are broad, showing a patch or length of transparent glass. Both of these may be remedied on the negative to a certain extent, and then completed on the enlargement. To neatly remove a strong dark patch or a broad line from the developed print is a difficult operation, as it is liable to leave a rough surface that is awkward to cover again. It is better and much easier to block out the marks carefully on the negative, leaving a blank space where the injury occurs, and then retouch the print.

If the scratches are slight, a little fine dry black powder of almost any kind, applied with the ball of the finger and lightly rubbed across the groove, will often fill them up. Such as will not take kindly to this treatment must be dealt with as described hereafter.

Broad scratches and blank patches must either be painted in to match the colour of the film and the image on it, or the places must be entirely blocked out, and the marks afterwards dealt with on the enlargement.

Use a fine sable or camel-hair brush and water colours. To match the colour of the film use Payne's Grey, with indigo or sepia added to secure the correct tone and density. The first named colour will prove useful for intermediate tones, as it is semi-transparent when applied thin. Should the colour object to flow, wash the brush out and after damping it with saliva in the mouth, go over the place. It will then take the colour. When working against a soft undefined edge, give that portion of the film a little damping with water before applying the colour, so as to cause it to spread a little. A sharp edge or line can only be obtained when the film is perfectly dry.

The work should be done in a retouching frame, or a "makeshift" arrangement may be made by inserting the negative in a printing frame fixed at such an angle that a piece of paper placed beneath will reflect the light through the film.

Secure enough density in the repair, and if necessary additional colour may be placed on the reverse side, on the glass. Examine from time to time by transmitted light.

Scratches often occur on the sky. If this is dense fill up the bad place as already described, but should the sky be thin it can be entirely painted out and another sky introduced from a second negative. A cloud in unison with the scene could be painted on the back of the negative, but unless the operator can do it well it is better not to attempt it.

Pinholes.—These are often produced by dust settling on the film previous to exposure, and are represented by minute transparent specks. By passing a camel-hair brush over the surface of the plate before loading and dusting the

darkslide as it is held upside down, these may be avoided in future. They are extremely difficult to deal with and require a great amount of patience.

If very small and indented, rub a little lamp black over that portion of the surface where they are located, and then wipe off the loose dust from the film with a cloth wrapped round a flat piece of wood, or the head of a cork. The slight indentations will retain some of the colour.

The larger spots will require to be filled in, one by one, with a water colour or Indian ink, applied with very little moisture on the point of a fine brush or a quill pen. To do this properly, the negative should be quite dry, and held in a retouching frame during the operation.

Another method is to cover the entire surface with a retouching medium, and work over the holes with an HB lead-pencil cut to a fine point.

Many of these marks will be represented by white dots on the enlargement, but these are preferable to black specks, because the former can be touched up and softened by crayon or pencil.

Some professional retouchers are very clever in dealing with these imperfections. If the negative is very bad it should be sent to one of them.

Stains from long immersion of the negative in a pryo developer may be cleared by soaking the plate in the following solution :—

Hydrochloric acid ... ... 1 ounce.
Saturated solution of alum ... ... 1 pint.

This acts as a reducer if the immersion is very prolonged, so that the negative must be examined from time to time to note its progress. When sufficiently acted upon, thoroughly wash and dry.

Dark spots are better if not interfered with in the negative. They will obstruct the light passing through them and can be remedied in the enlargement. Skilled retouchers are able to work them down with the keen edge of an erasing knife, or fine emery cloth wrapped round a thin piece of wood, but there is great risk in undertaking the operation without previous experience.

Irregular Mottlings.—These present dark mottled marks all over the film. They are caused by allowing the negative to stand in the developing solution without sufficient rocking, and are almost past any remedial measure. The recommendations previously given concerning dark spots may be attempted, but are rarely satisfactory.

Semi-opaque patches are usually the result of imperfect fixation. It is rarely the fault of the plate-makers. Try refixing. Make up a new fixing bath as follows :—To 1 pint of a saturated solution of hypo add 1 ounce of acid sulphite of soda, and dilute with as much again water. Be sure that *acid* sulphite of soda is obtained. It is in the form of a powder—not crystals like the ordinary sodium sulphite. This solution imparts energy to the process of fixing, causing it to be more thorough and rapid in its action. If necessary leave the plate in the solution a few hours, occasionally rocking the dish. It is a splendid clearer and imparts brilliance to the film, helping it to print more quickly. Let the after-washing be thorough.

"Soot and Chalk."—An under-exposed negative which has been forced in development will produce a hard "soot and chalk" enlargement, without detail in the high lights or shadows. This is because the light has not been able to penetrate the denser portions, and the thin portions allow too much light so pass through.

To overcome this weakness two methods of procedure are open. One is to bleach the negative and then slightly tone it, and the other is to use a weak positive in conjunction with the negative.

In the first named plan the negative is dealt with by a modification of that usually employed for intensification. A saturated solution of bichloride of mercury is prepared, and the negative which has been previously well washed is soaked in it until the film is bleached throughout and the image on it assumes the appearance of a positive. The dish ought to be rocked during this operation to ensure regular action of the mercurial solution. To ensure permanence the plate must be subjected to a thorough washing by allowing the water to beat upon it from the tap while

the dish is held in a sloping position and kept moving about. If the negative was printed from in this condition it would be found to produce a print altogether lacking in contrast. What is now wanted is to give it a slight tone. A very weak solution of sulphite of soda will accomplish this. In four ounces of water dissolve five or six grains of sulphite of soda, and place the negative in it until the film assumes a pale brown tint; then rinse and dry. If the contrast, which may be tested by a contact bromide print is not sufficient, a stronger solution will increase it, but generally it will be found that a very trifling addition of colour will be sufficient. Should the negative be overdone, a bath of hypo will bring it back to its original state, and the work can be recommenced again.

The second method is accomplished by placing an unexposed plate film-to-film with the negative, making a short exposure, and developing the positive so as to produce a faint image. If very little pyro and bromide are used, with the full strength of ammonia, when mixing the developer, a thin evenly-graded transparency suitable for the purpose will be obtained. The addition of half as much again water will allow of control and keep down density. The highest lights should be clear glass and the shadows very faint. The plate must then be fixed and washed in the usual way. It will be readily comprehended that if these two plates, the negative and positive, can be placed accurately face to face with each other, as they were when the exposure was made for the positive, we have simply obtained a thicker negative with glass at each side as a protection. The superimposition of the plate has added nothing to the high lights of the negative, because the positive is clear glass when these occur, while the shadows which were transparent have received the compensation they were in need of. To secure this accurate register the two plates must bed themselves well into one of the corners of the printing frame when the exposure is made, and a record should be kept so that the edges at which the plates register may be known when the enlargement is to be made.

Weak Image.—A negative that is extremely thin produces a flat print, and it is often preferable to resort

to intensification than to attempt to correct the weakness in the exposure. The methods of intensification are well known and need not be described here; the danger is in over-doing the work. After bleaching and washing, immerse the negative in a 10 per cent. solution of sulphite of soda until the film is darkened throughout. Usually this will strengthen the high lights of the image quite sufficiently, and make a great improvement.

Extreme Density.—The clearing formula mentioned on page 111 will also reduce density when the soaking of the negative is prolonged. Twelve or more hours immersion may accomplish the end sought, and in that case no other preparation need be used; but should the density be so extreme that very little impression has been made upon it, a more powerful reducer will be required.

The best for this purpose, and one that does not stain the film, is a weak solution of chloride of lime or bleaching powder. Purchase one pennyworth and put a small quantity, say half an ounce, into a ten-ounce bottle; fill up with water. Give it a good shaking, and then filter into a jug. After it has stood a while to settle, pour the clear portion to be used back into a clean bottle. Before applying the solution soak the plate in water for ten minutes. Try a little upon a useless negative, to gain a knowledge of its strength. If too strong, reduce by adding water. Should the first application not be sufficient repeat the treatment. The film must be well washed after reduction to eradicate all the remains of the solution.

Local reduction may be performed by applying the solution with a camel-hair brush to the parts requiring it; at the same time holding the plate against the light, so that the effect can be seen, and in such a position that any of the solution running down may not do harm.

Care should be taken that none of the solution falls upon clothing or it will bleach the colour in it.

Ferricyanide is often used for reducing density, but it usually leaves a yellow stain which interferes with the penetrating action of the light, and for that reason it is not suitable for negatives intended for enlargement.

SECTION XXIV.

MULTUM IN PARVO.

Bromide Opal Enlargements.—The same emulsion that is supplied on paper is also to be obtained on opal glass. Similar treatment, so far as exposure and development are concerned, as would be given to paper may be applied. Carefully avoid under-exposure and over-development. Treat any tendency to frill exactly as in the case of paper. If a white margin is preferred, cover it with straightly-cut strips of red or black paper attached with gum. They will come off during the development.

Utilizing an Optical Lantern.—Although the objective lens may not be the best instrument for this purpose, enlargements may be successfully made by the ordinary optical lantern from negatives of lantern-plate size. By substituting a rapid rectilinear or a portrait lens in place of the usual objective lens, the operation will be greatly facilitated.

Negatives of larger dimensions should be reduced, just as lantern-slides are produced by reduction in the camera, except that a negative must be made afterwards by contact from the positive.

The four-inch condensers of an optical lantern will give good results up to 15 × 12, if the focussing is accurately performed in connection with both reducing and enlarging.

If the lantern is illuminated by oil a rather long exposure may be necessary, but a test slip will give an idea of the value of the light. Lime-light is preferable, and a comparatively short exposure will suffice.

Development without using a Dish.—After soaking the exposed sheet, lay it while wet upon a sheet of glass, and apply the developing solution by means of a flat camel-hair brush (such as is used for letter copying) or a sponge. If the latter is used it must be quite free from grit and impurities. The stock of developing solution should be kept in a measure, and a little poured out from time to time on the centre of the sheet. The brush must be kept constantly working over the image, every portion receiving attention until full depth of colour is obtained.

This method allows plenty of control over the development, and there is a constant supply of fresh solution as the previous applications become oxidized from contact with the atmosphere. The operation should be performed over a sink so that the old solution may be swept off as it becomes exhausted.

Table of Exposures for Enlarging.—Mr. E. Ferrero supplied the following table to the *British Journal Photographic Almanac* of 1889. He introduced it as a system of exposures applied to enlarging on similar lines to those employed in the taking of direct photographs. It necessitates the use of Stanley's actinometer to gauge the light value, and also a knowledge of the focal values of the stops governing the lens. With these, it may be useful, especially if the negatives have been something like uniformly developed. It is intended for strong illuminants.

The tables shows the exposures to be given to Eastman's and Ilford Co's **slow** bromide paper, according to the actual intensity ratio of the lens, and the actinic power of the light. For other papers the difference in time must be calculated.

The negative used to obtain the figures is described as "clear and rather thin, just dense enough to give a good silver print."

To make use of the table, let us suppose the lens is working at $f32$; the actinometer is placed close to the negative, and the time it requires to register the standard tint noted. We will suppose that the time is fifty seconds, we find this figure in the first column of the table, and following the line indicated we find, under the column headed $f32$, that the exposure is three minutes.

Actinometer Stanley's	*f*/16	*f*/22	*f*/26	*f*/32	*f*/40	*f*/48	*f*/72	*f*/100
Seconds	min. sec.	min. sec.	min. sec.	min. sec.	min. sec.	min. sec.	min. sec.	min. sec.
10	0 9	0 17	0 23	0 36	0 55	1 20	3 0	5 47
15	0 13	0 25	0 34	0 54	1 23	2 0	4 30	8 40
20	0 18	0 32	0 46	1 12	1 51	2 40	6 0	11 34
25	0 22	0 42	0 57	1 30	2 18	3 20	7 30	14 27
30	0 27	0 49	1 9	1 48	2 46	4 0	9 0	17 21
40	0 36	1 5	1 34	2 24	3 42	5 20	12 0	23 8
50	0 45	1 24	1 54	3 0	4 36	6 40	15 0	22 54
60	0 54	1 38	2 18	3 36	5 32	8 0	18 0	34 42
70	1 3	1 54	2 42	4 12	6 28	9 20	21 0	40 20
80	1 12	2 10	3 7	4 48	7 24	10 40	24 0	46 15
90	1 21	2 29	3 28	5 24	8 18	12 0	27 0	52 0
100	1 30	2 48	3 48	6 0	9 13	13 20	30 0	57 48
120	1 48	3 16	4 36	7 12	11 5	16 0	36 0	69 24
140	2 6	3 48	5 23	8 24	12 56	18 40	42 0	81 0
160	2 24	4 20	5 14	9 36	14 48	21 20	48 0	92 0
180	2 42	4 58	6 56	10 48	16 36	24 0	54 0	104 0
200	3 0	5 36	7 36	12 0	18 25	26 40	60 0	116 0
225	3 22	6 18	8 33	13 30	20 45	30 0	67 30	130 0
250	3 45	7 0	9 30	15 0	23 0	33 20	75 0	144 0
275	4 7	7 42	10 27	16 30	25 20	36 40	82 30	159 0
300	4 30	8 24	11 24	18 0	27 40	40 0	90 0	174 0

Large Condenser made from Clock Glasses.—These may be constructed, but present greater difficulties than are generally supposed, and when made are not equal to those produced by the optician. The glasses are usually so flat in their curvature that the condensers made from them possess too great a focal length, and as the illuminant requires to be placed at a distance not less than the focal length of the condenser, the cone of rays collected by the latter is necessarily small and in consequence the illumination is weak.

The difficulty may be partly overcome by the introduction of a third lens of smaller diameter between the illuminant and the pair of large lenses, thereby gathering a larger cone of light. The whole would form a triplet condenser. Anyone who is in possession of an odd single lens that has previously formed half a condenser may utilize it for this purpose.

Construct the large lenses as follows :—Purchase from a clock-maker's material dealer two concave glasses, such as are used for covering clock dials, of a larger diameter than the diagonal of the negatives for which they are to be employed. Obtain or cut two discs of perfectly clear flat glass, the same size as the clock glasses, but leave a small aperture in the margin for filling purposes. Join the flat to the concave glasses at the edges by opticians or a good waterproof cement, overlapped by a strip of linen or strong tape which must be stretched and made to cling tightly to the edges all round except where the aperture is. The joint must be allowed to set thoroughly hard, after which a second coat of cement is applied to the cloth. When the binding has become firmly attached to the glasses, and every precaution taken again leakage, pure glycerine or filtered water is poured in. By this means a pair of plano-convex lenses will be produced. To these the smaller sized lens already referred to should be added, the whole forming a compound condenser of large size. The openings in the margins should be placed at the top, and must be left open to allow for expansion and contraction. A wooden framework will serve to hold the lenses in their respective positions.

Relative Speeds.—A writer in the *Amateur Photographer* supplies the relative speed values of the following brands of bromide paper, exposed under a Warnerke's sensitometer tablet, to a No. 5 Bray's burner at a distance of three feet. All were developed under similar conditions.

The first column gives the sensitometer number, and the second the relative speed :—

	Sensitometer Number.	Relative Rapidities.
Alpha Paper	14	21
Eastman	22	$2\frac{1}{3}$
Do. Rapid	25	1
Fry's Argentotype	18	7
Ilford Slow	16	12
Do. Rapid	25	1
Mawson & Swan	18	7
Morgan & Kidd	20	4

The above figures may be correct or otherwise, and the author assumes no responsibility concerning them. As previously stated, figures representing rates of speed are no criterion of quality, &c.

SECTION XXV.

FORMULÆ FOR BROMIDE ENLARGEMENTS.

Ferrous Oxalate.—*Ilford.*

No 1.

Neutral Oxalate Potash ...	1lb. avoirdupois
Warm Water.....	64 ounces
Bromide Ammonium	20 grains

No 2.

Sulphate Iron	1lb. avoirdupois
Warm Water.....	48 ounces
Citric Acid	½ oz. avoirdupois

Filter and use when cold.

For use, add 1 ounce No. 2 to 6 ounces No. 1, not *vice versa.*

Mawson & Swan.

No. 1.

Neutral Oxalate of Potash	20 ounces
Bromide of Potassium	40 grains
Distilled Water to make	80 ounces

No. 2.

Sulphate of Iron	6 ounces
Sulphuric Acid	12 minims
Distilled Water to make	18 ounces

To seven parts of No. 1 add one part of No. 2 just before using.

Eastman Co.

No. 1.

Oxalate of Potash (neutral)	1lb.
Hot Water	48 ounces

No. 2.

Proto-Sulphate of Iron	1lb.
Citric Acid	½ ounce
Hot Water	32 ounces

No. 3.

Bromide Potassium	1 dram
Water	10 ounces

These solutions keep separately, but must be mixed only for immediate use.

To 6 ounces of No. 1 add 1 ounce No. 2 and ½ dram No 3 (or about 5 drops of No. 3 to the ounce of developer.)

Morgan & Kidd.

No. 1.

Neutral Oxalate of Potash	16 ounces
Citric Acid	1 dram
Hot Water	50 ounces

No. 2.

Iron Sulphate (pure)	15 ounces
Acid Citric	1 dram
Hot Water	30 ounces

No. 3.

Bromide of Potassium	1 ounce
Water	20 ounces

Add to 6 ounces of No. 1, 1 ounce of No. 2, and 6 drops of No. 3 to be mixed in the order given.

Captain Abney.

No. 1.

Potassium Citrate.....	700 grains
Potassium Oxalate	200 grains
Distilled Water	3½ ounces

No. 2.

Ferrous Sulphate	300 grains
Distilled Water	3½ ounces

Add equal quantity of No. 2 to No. 1. No bromide needed to restrain.

Eikonogen.—*G. Wheeler's original formula* A.

No. 1.

Acid Sodium Sulphite	60 grains
Eikonogen	120 grains
Warm Water to make	10 ounces

No. 2.

Potassium Carbonate.....	240 grains
Potassium Bromide	8 grains
Cold Water to make	10 ounces

For normal exposures use three parts of No. 1 and one part of No. 2. For under-exposures increase the proportion of No. 2. For over-exposures reduce the proportion of No. 2. For softer tones add extra water. If preferred, commence with old developer.

The developing agent is unusually strong in proportion to its preservative, and will give an intense engraving black with grey half-tones and high lights.

The solutions act better when freshly made; they begin to deteriorate after the first month.

Clear with water only and use acid fixing bath.

Dr. Stolze.

No. 1.

Sodium Sulphite	300 grains
Eikonogen	60 grains
Distilled Water	10 ounces

No. 2.

Carbonate of Potash	750 grains
Distilled Water	10 ounces

Use No. 1, 5 parts; No. 2, 2 parts; water, 18 parts.

The proportions should be altered to suit the exposure and to secure the tone wanted.

G. Wheeler's formula B.

No. 1.

Eikonogen	120 grains
Acid Sulphite of Soda	120 grains
Water (warm) to make	10 ounces

No. 2.

A Saturated Solution of Washing Soda.

Put the eikonogen and acid sulphite into a 10-ounce bottle, and fill up with warm water. Shake till dissolved. No. 2 should be well shaken up before use, and always have some undissolved crystals at the bottom of the bottle.

Use No. 1, 1 ounce; No. 2, 3 drams; water, 1 ounce.

It gives grey tones with a short exposure. Increasing the proportion of No. 1 intensifies the black tones. More water produces a softer image, and the developer will work more slowly, with a tendency to warmer tones. In cold weather take the chill off the dishes and solutions before use.

Hydroquinone.—*Ilford Co.*

No. 1.

Hydroquinone	160 grains
Bromide Potassium	30 grains
Sulphite Soda	2 oz. avoir.
Water to	20 ounces

No. 2.

Soda Hydrate	100 grains
Water	20 ounces

For bromide paper use 1 part each of No. 1, No. 2, and water. For alpha paper use 1 part No. 1, half part No. 2, and 2 parts water.

"*Amateur Photographer.*"

No. 1.

Hydroquinone	154 grains
Sodium Sulphite	437 grains
Sulphurous Acid	20 minims
Distilled Water to make	10 ounces

No. 2.

Sodium Carbonate	1300 grains
Potassium Hydrate	154 grains
Potassium Bromide	20 grains
Distilled Water to make	10 ounces

Mix in equal parts and dilute with three times the quantity of water. Gives a black tone.

American.

No. 1.

Hydroquinone	40 grains
Sodium Sulphite	160 grains
Water to make	10 ounces

No. 2.

Sodium Sulphite	160 grains
Sodium Hydrate	80 grains
Potassium Bromide	10 grains
Water to make	10 ounces

Use equal quantities of each.

Eikonogen and Hydroquinone.—

F. T. Chapman.

No. 1.

Hydroquinone	40 grains
Eikonogen	120 grains
Sodium Sulphite	480 grains
Citric Acid	20 grains
Distilled Water to make	20 ounces

No. 2.

Potassium Bromide	5 grains
Sodium Carbonate (pure)	60 grains
Sodium Hydrate	30 grains
Distilled Water to make	20 ounces

Mix in equal proportions and add an equal quantity of water.

Rodinal.—

Rodinal Solution	20 to 25 minims
Water	4 ounces

Use old developer as a restrainer, or add 5 drops of a 10 per cent. solution of potassium bromide. To obtain greater depth of tone more rodinal may be required, but it must be accompanied by extra bromide or the paper will fog.

Clearing Solutions.—*Ilford.*

Water	80 ounces
Sulphuric Acid	½ ounce

Immerse prints, without washing, for about two minutes, then pour off and repeat.

Eastman Co.

Acetic Acid	1 dram
Water	32 ounces

Allow it to act one minute; pour away and repeat twice.

Morgan & Kidd.

Acetic Acid	1 ounce
Water	12 parts

Soak print for five minutes in the above.

Sulphuric Acid	1 ounce
Water	80 ounces

If print shows signs of yellowness after fixing and final washing, place it in the above solution and then wash it in water for two hours.

Mawson & Swan.

Acetic Acid	½ dram
Alum	½ oz. avoir.
Water	10 ounces

Soak for a minute or two, then pour away and apply a second quantity for a like time.

Fixing Solutions.—*G. Wheeler's.*

Acid Sulphite of Soda	2 ounces
Saturated Solution of Hypo	1 quart

To 1 part of the above add 5 parts water. Prints to remain 15 to 20 minutes in the solution.

Morgan & Kidd.

Hyposulphite of Soda	6 ounces
Water	40 ounces

Fifteen minutes in the above.

Mawson & Swan.

Hypo	3 oz. avoir.
Water	20 ounces

Eastman Co.

Hyposulphite of Soda	4 ounces
Water	20 ounces

Ilford Co.

Hyposulphite of Soda	1lb. avoir.
Water	80 ounces

Allow fifteen minutes for fixation.

Alpha Paper.—*Ilford.*

No. 1.

Oxalate of Potash (Neutral) ...	1lb. avoirdupois
Bromide Ammonium	320 grains
Warm Water	64 ounces

No. 2.

Sulphate of Iron	4½	ounces avoirdupois
Citric Acid.....	½	,, ,,
Water	80	,, ,,

Filter, and do not use until cold.

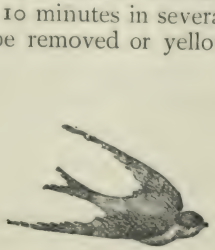
For use add 1 part of No. 2, to 3 parts of No. 1, not *vice versa*. It will be noted that the developer is weak and much restrained, a more vigorous formula is unsuitable. Development is complete when image appears fully out. At this stage a correctly exposed print will be of a warm brown colour, with a peach bloom over the whole surface. Over exposures are indicated by a yellowish red colour, and under exposures by greenish black.

Old developer, freshened with a proportion of new, just before use, gives the best results. This is best kept in a bottle filled up to the stopper, replenished from time to time as required, with the two solutions freshly mixed. After development, and without washing, immerse for about *half a minute* in clearing solution, pour off and repeat.

Clearing Solution for Alpha Paper.—*Ilford.*

Water	80 ounces
Sulphuric Acid	½ ounce

This has a reducing action on Alpha prints, therefore do not allow them to stay in the bath longer than time given, unless it is desired to correct over-development. Wash thoroughly for 8 to 10 minutes in several changes of water; all the acid must be removed or yellowness of whites will result.



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THE OUTCOME OF PRACTICAL WORK.

Order our goods from the ordinary Photographic Material Dealers. (We allow full trade discount—to trade only.) If they will not supply you, write direct to 46 King Street West, Manchester.

WHEELER'S
CARDBOARD PROTECTING
MASKS
FOR UNDEVELOPED PLATES.

By inserting one of these cards between the plates, they are effectually prevented from touching each other, and risk of breakage is avoided, as the pressure is equally distributed around the margin.

These masks also help to exclude dust.

Their thickness adds little to the bulk, as fifty cards go in less than half an inch, and the weight is merely nominal.

INVALUABLE FOR TOURISTS CARRYING UNEXPOSED PLATES.

TESTIMONIALS.

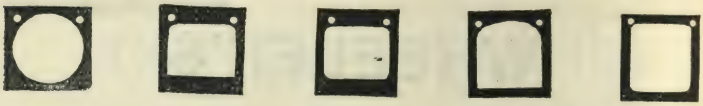
"The Cardboard Masks are excellent, and will be appreciated by all tourists."—*Paul Langé.*

"Wheeler's Cardboard Protecting Masks are certainly among the most useful novelties for tourists. Anyone who has taken plates away on tour knows the trouble of placing the exposed plates back in the boxes so that they will not scratch, rub, or become marked by the dividing papers. The masks in question are mere frames cut out of pure cardboard, and rest only on the margin of the plates and take up but little room. They form a very efficient protecting and separating medium. We predict a big sale for these as the holiday season comes on."—*Amateur Photographer*, April 22, 1892.

"Their use will be found a great boon to the tourist who desires to pack his plates on tour with some amount of certainty that they will be free from damage both mechanically and chemically. The masks add but little to the bulk, as 50 cards go in less than half an inch, and the weight is infinitesimal."—*Photography*, April 21, 1892.

BOXED IN THE FOLLOWING SIZES:—

¼-plate, 6d.; 5 x 4, 9d.; ½-plate, 1/-; postage extra.



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Wheeler's

READY-MARKED LANTERN-SLIDE MASKS.

Each mask has two small distinct white dots on it, to mark the top and face of the slide, so that when the mask has been inserted between the two glasses and bound together, the slide is complete. Not only is the trouble of attaching these small discs avoided, but they are protected from falling off by friction and heat (a constant source of annoyance with the old method), and there is the certainty that the masks are on the right side of the slide.

They are made in **Contact and Reduction** shapes as follows:—

CONTACT SHAPES.

No. 1—Large Cushion
2—Small do.
3—Circle
4—Dome
8—Mixed Contact

REDUCTION SHAPES.

No. 10—Oblong Cushion
11—Upright do.
12—Oblong Oval
13—Upright do.
14—Oblong Dome
15—Upright do.
16—Mixed Reduction

ONE SHILLING per Box, containing 80 Masks.
Postage extra.

Register No. 4250.

WHEELER'S
ANTI-HALATION PAPER,
FOR BACKING PHOTO. PLATES.

This paper has been prepared as a remedy against halation, and may be quickly applied. Practically it consists of a thin tough (although porous) paper, coated with a reliable backing substance.

The old form of backing by colour applied with a brush was liable to create innumerable pinholes over the film; the powder, when dry, becoming loose and working round to the face of the plate, if the camera was shaken. The Anti-Halation paper avoids this annoyance, and thus tends to secure perfect negatives.

It is covered on one side with an adhesive non-actinic substratum that is intended to be damped and attached in optical contact with the back of the plate. Being cut to a size rather less than the plate, to back half-a-dozen plates is but the work of a few minutes.

DIRECTIONS FOR USE.

Lay the double backs open and insert the unexposed plates, film side down. Pass a rather damp sponge once over the substratum on the surface of the paper, and lay it on the back of the plate, pressing it into optical contact by running a roller squeegee over from end to end. Let them dry for a few minutes before closing the backs.

To remove the sheet use a damp sponge.

If common glycerine is used in place of water, the backs may be closed at once. Glycerine will not cause the joints of the backs to open, as damp from water does, and the trouble in removing the backing is reduced to a minimum.

The sticking substance contains nothing that will harm the most sensitive film, so that the plate, with the backing attached, may be immersed in the developing solution right off, and will strip directly after.

TESTIMONIAL.

"It is extremely convenient and cleanly in use and of practical benefit. For all outdoor work we have recommended times without number the backing of plates, now that the operation is so much facilitated, everyone should adopt this precaution against halation, flatness, and want of general brilliancy."—*Amateur Photographer*, April 22, 1892.

PRICES (In Boxes containing 50 Sheets):

¼-Plate, 6d.; by post, 8d.
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A pure vegetable paper, unbleached and unsized; free from chloride of lime, hypo, or other deleterious substances usually found in ordinary paper, and which often cause the images on the films to fade in a short time.

Per 500 Sheets:—

1/4-plate, 6d.; 5 × 4, 6d.;

1/2-plate, 9d.; Double 1/4-plate, 9d.;

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INTERCHANGEABLE
ALBUMS
FOR UNMOUNTED PHOTOGRAPHS.

Thoroughly Serviceable and Handy.

Made from tough cartridge paper, strongly bound in leather and cloth, and neatly finished in gold.

The prints are held in position at each corner by a small curved cut, which covers very little of the picture.

Photographs may be taken out and fresh ones inserted in a few minutes without damaging the leaf, and mounting is entirely dispensed with. The paper is stout and unusually tough, and the binding is of a substantial character.

No. 1	To hold 72 ¼-plate (oblong)	2/-
No. 3	„ 72 ½-plate „	3/6
No. 4	„ 144 ¼-plate (two on a page)... ...	4/-
No. 5	„ 144 ½-plate (oblong)...	5/-
No. 6	„ 72 1-plate „	6/-

Postage extra.